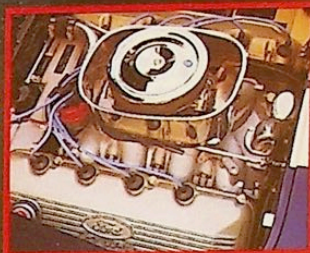


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THE SPECIALTY CAR MAGAZINE

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Parts Guide  
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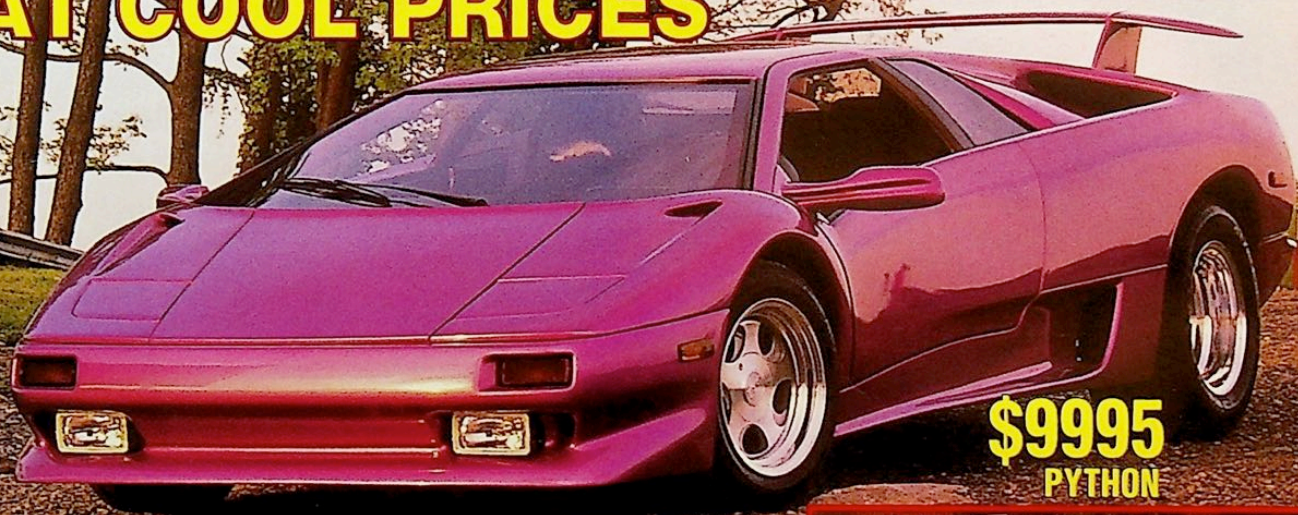
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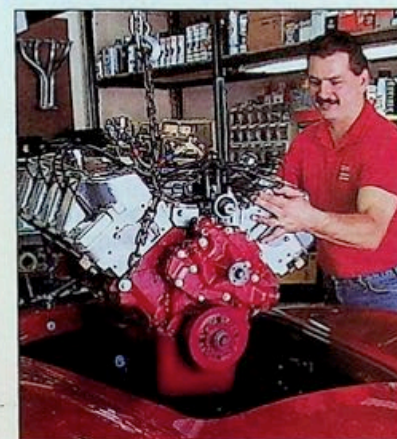
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High \$ looks, low \$ budget 16



Tips on engine tech 31



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ERA's period piece 76

**On the Cover:** This bevy of low-buck exotic beauties is featured on p. 16. Or if you're cost-conscious about a Cobra, see the new \$9900 5.0 Mustang-Donor Cobra on p. 24. Need some tech tips on power for your kit? Check out our new Engine Tech section starting on p. 31. Cover photography by Steve Temple and Jim Youngs.

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# KIT CAR

## THE SPECIALTY CAR MAGAZINE

November 1995 • Volume 14, Number 6

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## UP FRONT

### Survey Said

The results are in! Our March '95 issue included a questionnaire on your kit-car interests and activities, and what we've found from the responses is an amazing mixture of the expected and unexpected. Drawing from previous surveys and personal experience, we weren't surprised by your age, income, and educational level. Compared with Petersen Publishing's 70 or so other magazines, Kit Car readers are among the most mature and affluent, with an average age in the mid-forties and a significant percentage above 55 years old. Clearly, you've been around the block more than a few times and have a seasoned perspective on the automotive scene. Judging from the stats, building a kit car is not kid stuff—you take your hobby seriously and invest a good chunk of your hard-earned money in it. And you have more than a few nickels to rub together over a kit-car purchase—Kit Car readers have an average household income of \$68,000, and 30 percent earn over \$75,000 per year. You must be smart, too, because more than three fourths of you are college-educated. (I guess I'll have to start keeping a closer eye on my grammar and spelling.)



Virtually all of the survey respondents were male, but judging from the shows we attend and the kit-car owners we meet, women enjoy kits just as much—they just make their husbands fill out the forms. How involved are you with your kit cars? More than two thirds own at least one kit car, and 20 percent have two or more! You spend a significant amount of time and money perfecting your projects: down to the last detail. Last year Kit Car readers spent on average more than \$500 (on their projects, with 17 percent shelling out more than \$5000). About three fourths of you buy new aftermarket components (through mail order or at auto parts stores, while less than 5 percent are willing to scrounge through a salvage yard. (The early days of the purchase are long gone.) Most of the products, accessories, and driven components—front end, suspension, radiators, rear ends, and everything in between. (As we already know from looking at the kit market, the range in types of vehicles owned is diverse, with rebodies of '60s and older vehicles (both classics and Cobras)

showing up in the kit-car scene. Cobras and VW-based kits still hold their own, but up about 20 percent of the rebodies are almost 30 percent, and street rods and other types add up to about 15 percent (the total exceeds 100 percent due to multiple responses).

In view of all the Cobras out there, we weren't surprised to learn that about half the engines used are V6s, but we were a bit surprised to find that within this number it's a 50/50 breakdown for Ford versus Chevy. (With so many Cobras out there, we thought that Ford engines might predominate. On the other hand, the percentage of Chevy engines tends to be much higher in Petersen's other special-interest automotive magazines.) More than one third of the respondents have four-bangers under their hoods, and most of those engines are air-cooled VWs. Eleven percent of all survey respondents own "other" engines (which might mean anything from Mopar power to a Mazda rotary to a two-stroke motorcycle engine).

What are you planning to buy? About one third are considering replicas of either Cobras or other classics, while another one third of you want rebodies of production cars, possibly because of the simplicity of registering and insuring this type of kit. (We plan to provide more information in future issues on these latter subjects.) Cost considerations may also be a reason for the interest in rebodies, since it's no secret that there's less money to go around these days. About 20 percent want a custom exotic and 10 percent are thinking about a street rod. VW conversions and other types make up the remaining 15 percent or so (again, multiple responses account for a total exceeding 100 percent). Whichever type you have in mind, 63 percent prefer to buy a new kit, and two thirds plan to do so within the next two years.

About half of you intend to handle every bit of the buildup work yourself, and another 25 percent plan on assembling at least three fourths of your kit. All of which shows that Kit Car readers are skilled, hands-on enthusiasts. Well, we knew that already.

*Steve Temple*

PHOTO: JOE GREEVES

## KIT CAR

THE SPECIALTY CAR MAGAZINE

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# MAILBOX

## SCRATCH AND SNIFF

I have several suggestions concerning the editorial content of your magazine. First, lose most of the Cobra stuff. Second, get a bit more technical. Go read *Circle Track* for a few issues to see what I mean. I am not a kit builder. I am a scratch builder and would appreciate articles concerning the relationship between suspension geometry, chassis rigidity, and street tires. I also want to know how to calculate spring rates and motion ratios. Some information or straightforward structural analysis on how to calculate static loads in a three-dimensional truss would be very useful to those trying to figure out the quality of tubing to buy. I could also use some information on why a street performance car shouldn't use a big-block. Or perhaps you could write about the layout of bucks and molds for building your own bodywork. (Why should my car look like a Ferrari?)

Right now your magazine comes off sort of, "Gee whiz, pictures of real kit cars, and some are painted red!" It about defines sophomoric. If in its sophomoric style it didn't on occasion present something of real value, I wouldn't even read it at the checkout stand, let alone buy it. In short, let's have more technical stuff and less Hot Rod magazine.

Brian Knowles  
West Point, CA

Sophomoric? We couldn't even make it through our freshman year. Actually, Brian, we certainly appreciate your suggestions, but you're missing a big point. *Kit Car* is a magazine written primarily for kit builders, not scratch builders. Although we have in fact recently covered many of the subjects you mentioned, most of our tech articles are for assisting readers in assembling various kits. We do read *Circle Track* (its offices are right next to ours) and have consulted its editors a time or two on various tech subjects. Your comment about getting rid of Cobra coverage is unrealistic. We realize some readers are tired of this type of replica, so we always provide a diverse range of kits in every issue. The truth is, however, if it weren't for Cobra replicas there might not be a kit car industry or *Kit Car* magazine. Cobra replicas are clearly the kit of choice for most readers, largely because they're relatively easy to build and furnish an exhilarating dose of performance. Your reference to Hot Rod is

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off-base as well, because we are an offshoot of that magazine. And besides, the million-plus readers of Hot Rod can't be all wrong.

## PANTERA PASSION

I purchased your magazine for the first time today and found it fascinating that



these beautiful cars were within reach. I was wondering, however, if you have any kit information on my favorite exotic, the Pantera GT-5?

Christopher S. DeRocha  
New Orleans, LA

A Pantera kit was produced briefly several years ago but is no longer in production. However, a Fiero reborn with similar lines is being developed by Thomas D. Ricotta (619/724-1688).

## LAND OF THE LOTUS EATERS

In your article "New Brit Kits" (November '94), you mentioned three British builders (DJ Sportscars, Caterham, and Westfield), but you didn't include the companies' addresses and phone numbers so we could get further information from these builders. Could you please provide this information as well as the names, addresses, and phone numbers of any American companies who make Lotus kits?

Charles E. Stewart II  
Baltimore, MD

Caterham is featured in this issue, and these are the phone numbers for Westfield (011 44 1384 400077) and DJ Sportscars (011 44 1279 442661). For a U.S. manufacturer of Lotus-style replicas, try Rotus (301/416-7277).

## BUG BITS

I am interested in buying and fixing up a Volkswagen. Could you please send me a list of any catalogs pertaining to VW

parts? Anything would be appreciated.  
Scott Johnson  
Elmwood Park, NJ

We normally don't respond to individual inquiries for catalogs, but we do have a catalog section in this issue to help you find all sorts of stuff, including VW parts.

## SUPER NOVA

A new company called Nova Developments has come to my attention. I would like to obtain information on its new Nova kit car. As someone greatly in the know with regard to British kits, could you please furnish me with its address?

Arthur Tofani III  
Conshohocken, PA

We'll refer you to "The British Are Coming" in our previous issue (September '95), which featured a number of British kits, including the Nova. Call 800/800-5227 to order a back issue.

## AIR PORSCHE

I am seeking the address and phone number of Aero Dynamics (or any other



kit car company that offers an aerobody package for a Porsche 914).

David W. Rayburn  
Medford, OR

We haven't seen anything lately on the whereabouts of Aero Dynamics. However, in addition to its new \$1500 body kit shown here, Rayco (314/621-1321) offers a wide range of other mods for the Porsche 914. Also, try P.R.O. S.C.A. (805/251-5910).

Letters in *Kit Car* reflect the opinions of the writers and do not imply the endorsement of this magazine. All letters should be addressed to Mailbox, *Kit Car*, 6420 Wilshire Blvd., Los Angeles, CA 90048-5515. Letters should include the writer's name, address, and telephone number. We reserve the right to edit letters for clarity, brevity, or other editorial purposes. Due to the volume of mail received, we cannot answer letters privately.

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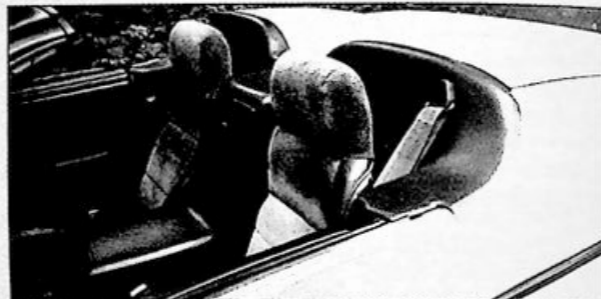
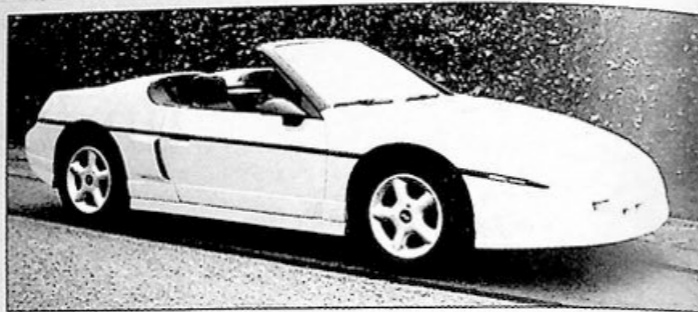
The Factory Five 427 SC Cobra kit comes complete with everything you need to build your Cobra except a single donor Mustang 5.0. The Cobra pictured above was built from our \$9900 kit and a 1991 side-hit Mustang 5.0. The total cost to build this vehicle was \$12,840, complete. 1900 lb., 50 State emissions legal, all bolt-on assemblies, and the proven performance/reliability of today's Mustang 5.0. To find out exactly what you get with this kit and complete specifications, call (508) 984-3588 between 8:00 am - 6:00 P.M. EST. Mustang and Cobra are registered trademarks. Factory Five is not connected to holders of these trademarks. ©1995 Factory Five Racing.

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# SPECIALTY SCENE

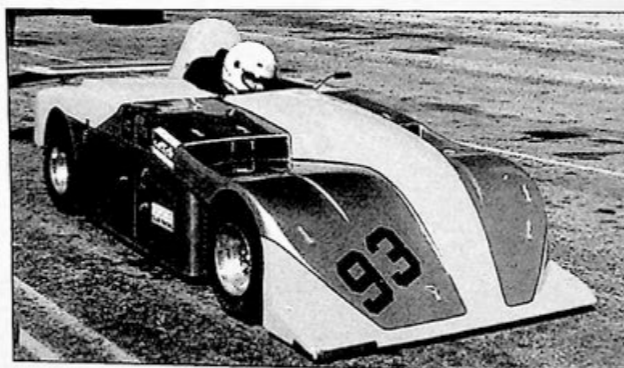
## FIERO SPEEDSTER

Maybe you want your Fiero to look different but still identifiable as a Pontiac. This new Fiero Speedster conversion from GSR USA creates a really sharp new look without disguising the car's character. Unlike most fiberglass Fiero rebodies, the \$3995 kit's components are all metal. A rear decklid assembly, rear quarter-panels, and a frame reinforcement are included. Installation of the kit runs about \$9300. GSR USA, Inc., Dept. KC11, 12700 Bel-Red Rd., Bellevue, WA 98005, 206/688-8817.



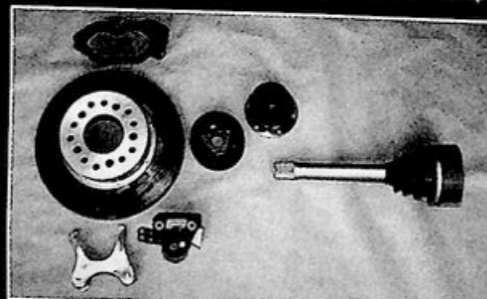
## RACY KIT

No, it's not a go-kart, and no, you can't drive it on the street, but the traXstar is potentially the fastest car in the world for its price—at least that's what designer Peter Derviller claims. He may be right. This \$20,000 kit, weighing only 800 pounds full-up when outfitted with a stock 130hp, 1.0-liter Honda Hurricane CBR1000 superbike engine, has attained a top end of 155 mph. Designed to race in the SCCA D-sports racing class, the traXstar can accommodate other motorcycle engine/gearbox units and has a fully adjustable independent suspension. traXstar Supercars Inc., Dept. KC11, No. 35-185 Woodridge Dr. SW, Calgary, Alberta T2W 3X7, Canada, 403/251-1748.



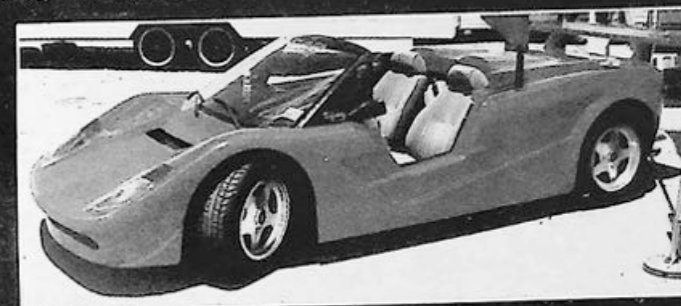
## ACE'S SUPER-LIGHT COBRA

At Ace Auto Services we recently spotted yet another way to skin a Cobra. This New Zealand import employs 1½-inch chrome-moly tubing in a triangulated bird-cage-style configuration. Ace says it tips the scales at a mere 1660 pounds with a small-block V8. Another unique feature is a new IRS that uses the Ford 9-inch center section in a cast-alloy housing with Porsche CV joints and halfshafts and custom-cast uprights and flanges. The rear end's housing, hubs, and uprights are available separately for \$3200. At the front is a custom-fabricated, tubular A-arm setup with coil-overs. Depending on currency rates, a rolling chassis with a body starts at \$30,000, which includes aluminum inner paneling. Also arising from Down Under in the coming months is a new Cobra Daytona Coupe replica. Ace Auto Services, Dept. KC11, 21422 Parthenia Ave., Canoga Park, CA 91304, 818/885-5097.



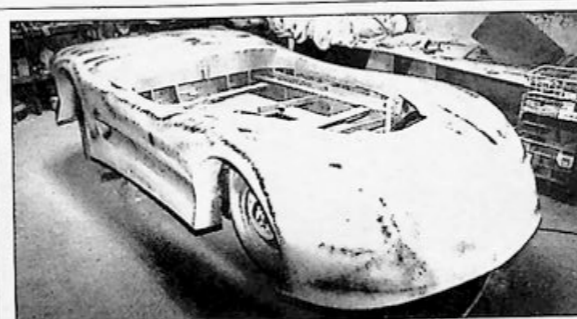
## MCLELA MCBUG

Many thanks to one of our sharp-eyed readers, Ted Whisenhunt of the Oklahoma Kit Car Club (405/360-0645), who spotted this sporty new McLela. With lines inspired by a McLaren Can Am racer, this new VW Beetle-based kit is offered at a bargain-basement price, starting at less than \$2800 for the one-piece body. Although it can be mounted directly on a VW pan, a recommended option is a 2-inch, round-tube subframe for structural reinforcement. The subframe surrounds the cockpit and simply bolts on the stripped chassis. A Honda Civic windshield replaces the stock unit, and the customer supplies interior upholstery and appointments, except on turnkey vehicles, which start at \$12,650. A mid-engine version with a custom tubular frame is available for slightly



## THE MARK II OF ERA

In researching our story on ERA's new 289 FIA Cobra (see "Period Piece," p. 76), we stopped by the factory in New Britain, Connecticut, and spotted another project in the works. The company's GT40 Mark I replica is generally acknowledged as one of the premier kits on the market, and molds for the long-awaited 427-powered Mark II version are nearing completion. Differentiated from the small-block Mark I model by the big-block engine and high-mount intake scoops on the rear quarter-panels, the Mark II will also feature ERA's original-style monocoque chassis. Unlike the rust-prone original unit, the frame will be welded in stainless steel.



## RIOT DEVELOPS

Thunder Ranch has just completed its mid-engine Lightning street rod, and work is progressing rapidly on the mold plug for the Riot. The latter vehicle uses a standard-length VW Beetle chassis but has a wider, 62-inch track, and larger wheels with spacers will be used to fill up the wheelwells. The projected price for the basic kit is \$3650. A roof and doors will be available as options. Thunder Ranch, Dept. KC11, 1468 N. Magnolia Ave., El Cajon, CA 92020, 619/444-1006.



## NICE CORVETTE, MAN

For those of you looking to use your '78-'88 Caprice for a project, we've got a suggestion. Nice Car (800/753-4158) offers a kit inspired by the much-desired '67 Corvette. Called the Reflection Series I, this package starts as low as \$9995 and features a solidly engineered, steel-panel subframe that mounts directly onto a GM midsize chassis. For increased passenger comfort, the Reflection is slightly larger than an original 'Vette and also has an opening trunk lid not found on the authentic item. **KC**



# OFF THE SHELF

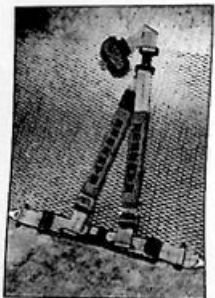
## SLICK SHIFTING

For a top-quality shift lever, look no further than Sola Gearshift. The company offers a complete line of billet alloy and exotic hardwood shifter handles. The Tiger design comes in a variety of translucent colors or natural wood finishes. The hardwood comes with a high-gloss finish sealed with a clearcoat finish for durability. Sola Gearshift, Dept. KC11, P.O. Box 131, Edgewater, NJ 07020, 800/882-7652, 201/278-4411 in NJ.



## HOT HARNESS SAFETY

If you are after that racy look for your project car's cockpit, Schroth Restraint Systems has a complete line of competition-style, 2-inch harness belts that meet all the tough European and DOT safety standards. The line includes the Rally three- and four-points, which are bolt-in items designed to wrap around a rollbar. Pictured is the Autocontrol inertia-reel system with all the comfort of a stock safety belt but the looks and feel of a competition safety belt. Schroth Restraint Systems, Dept. KC11, 1911 11th St., Ste. 203, Boulder, CO 80302, 800/884-2358.



## MAKING CONNECTIONS

The Key Switch from Flaming River Industries may be the answer to your car theft problems. The fully sealed and completely waterproof switch allows the battery circuit to be disconnected. This switch can be installed on all 12- or 24-volt electrical systems. It uses a unique twin-prong, noncorrosive, stainless-steel key, which is precision-cut to spring lock into the receiver. Flaming River Industries, Inc., Dept. KC11, 17851 Englewood Dr., Cleveland, OH 44130-3453, 800/648-8022.



10 KIT CAR

## DUST TRAP

Sanding a fiberglass kit body for paint prep can get really messy, but Clean Air Sanding Systems can help with the new DustTrap. It's a dust-collection shroud designed to keep the dust inside the sander. The company claims the DustTrap, made of rugged, bullet-proof, clear polycarbonate, removes dust as it is created, triples the life of abrasives, and provides a much cleaner shop environment. The DustTrap can be easily installed in more than 500 different models of sanders. Clean Air Sanding Systems, Dept. KC11, P.O. Box 7840, San Diego, CA 92167, 800/234-2426 (orders only), 619/523-1108.



## LOCKED OUT

Car thieves beware. The new Carlock 4WL Security System makes it impossible for a car thief to move a vehicle. The device is installed between the hydraulic master cylinder and the four wheel cylinders and is positioned beneath the floorpan. The basic Carlock 4WL Security System comes with the Brake System Lock Assembly, which is mounted under the floorpan with a locking cylinder projecting through the floor. The cylinder can be turned on and off with a special key. C-F Enterprises Ltd., Dept. KC11, 14130 Gannett St., No. 112, Santa Fe Springs, CA 90670, 310/404-0522.



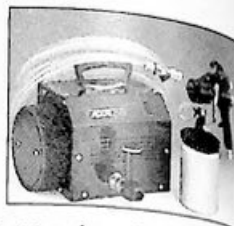
## TILT-A-WHEEL

Having trouble getting in and out of your cramped cockpit? The new Tri-C Engineering tilt column kit can solve this problem. It comes with a machined-billet aluminum housing and hub assembly, and the tilt mechanism has a quality needle-bearing U-joint with a locking mechanism. The hub is predrilled to accept any standard three-hole steering wheel pattern. Tri-C Engineering, Dept. KC11, 27820 Fremont Ct., Unit 3, Valencia, CA 91355, 805/295-1550.



## PRO PAINTER

If you want to reduce the amount of overspray while you are painting, try this new AccuSpray gun. Available from The Eastwood Company, this high-volume, low-pressure (HVLP) unit is said to reduce overspray up to 70 percent. It's ideal for both home hobbyists and professional shops alike. The AccuSpray features a more compact, redesigned, three-stage turbine unit, which operates on standard 110V current. The Eastwood Company, Dept. KC11, 580 Lancaster Ave., Malvern, PA 19355, 610/640-1450.



## CHERRY PICKER

Having a hard time getting that new engine into your kit replica? Try this new 1-ton-capacity engine crane from Lincoln. This Winner model conveniently disassembles for compact storage. A new long boom allows for low pickups as well as high lifting, and this unit has the advantage of being able to operate with air or hydraulically, eliminating the need for hand pumping. Lincoln, A Pentair Company, Dept. KC11, One Lincoln Way, St. Louis, MO 63120-1578, 314/679-4300.



## KING OF KLEEN

If you're using recycled components in your kit, make sure they're clean with this parts washer from Klever Kleen. The washer operates entirely on gravity, with no electricity required, and the patented design lets you rinse the biodegradable cleaning solution over and over. The washer includes two containers, a splash shield, and a hose equipped with a regulating nozzle that acts as the washing brush. The gravity-fed parts washer holds up to 1 1/4 gallons of cleaning solution. Klever Kleen Corp., Dept. KC11, 2410 S. 179th St., New Berlin, WI 53146, 800/699-5587.



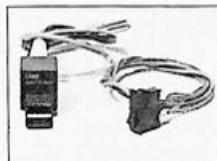
## HELLO, DOLLY

Is your kit project becoming a real pain to move around your garage? Check out these new automotive dollies from Kingsbury Dolly. They allow you to move your car or parts around easily, and you can combine the dolly with a jackstand to get your car up even higher. The company claims the 4-inch, soft-rubber wheels are the easiest rolling ones on the market today. They roll so easily that each dolly needs its own brake. Kingsbury Dolly Co., Inc., Dept. KC11, 128 Kingsbury Rd., Walpole, NH 03608, 800/4-1-DOLLY.



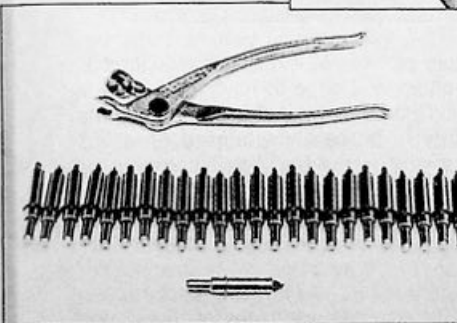
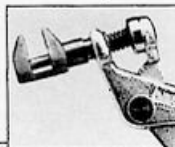
## ROCKIN' ROUND THE DASH

These new rocker switches will wow your buddies. They're simple, elegant, and high-tech-looking. They come in jet black and can fit in tight places due to their 3/8x1-inch size. StreetWorks says you can use them to operate turn signals, headlights and parking lights, hi-lo beams, or any on/off function you need to have switched. Each switch comes with its own separate leads, 40amp relays, and detailed installation instructions. StreetWorks, Dept. KC11, P.O. Box 270, Bozrah, CT 06334, 203/859-0513.



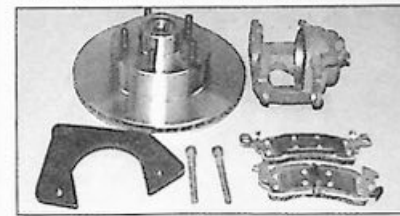
## CLECO CONNECTED

A great tool for kit car builders is this Cleco Kit from Speedway Motors. Cleco Kits temporarily hang sheetmetal, aluminum panels, or even fiberglass body panels while you install them permanently. Speedway's Cleco Kit includes a special, plierlike tool and 25 Cleco fasteners designed for 3/16-inch holes. Speedway Motors, Inc., Dept. KC11, P.O. Box 81906, Lincoln, NE 68501-1906, 402/474-4411.



## STOPPING SPREE

Need some whoa power to match the go power of your engine? RCC Specialty Products has new 11-inch Ford rotors and



calipers that bolt directly to Mustang II spindles using custom RCC brackets. The spindles require no modifications, and included are brackets, bearings, seals, and all fasteners. Flexible, stainless brake lines can also be added to the package for improved appearance and resistance to abrasion. RCC Specialty Products, Dept. KC11, 5609-F Parker Henderson Rd., Fort Worth, TX 76119, 817/536-3820.

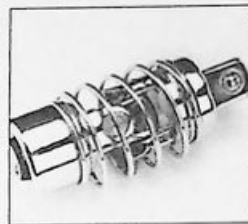


## IN THE FOG?

Perfect Performance Products' auxiliary light relay makes installing extra driving or fog lights easy and quick with this Painless Wiring Kit. A black, heavy-duty light switch with matching black bezel is included, as well as a complete, color-coded, preassembled wiring harness and a heavy-duty 30amp relay and terminal. Perfect Performance Products, Dept. KC11, 9505 Santa Paula Dr., Fort Worth, TX 76116-5929, 817/244-6898.

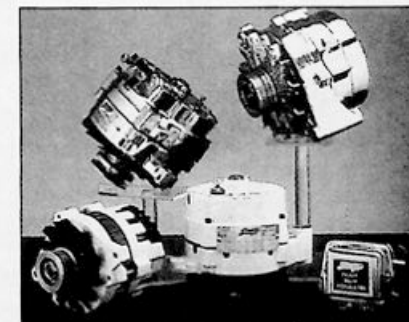
## SOCKET

Anyone who has worked on a car in his or her life has had a worn-out universal joint that flops to the wrong side in a tight, confined area. Sidewinder's new Cleveland Spring U-joint takes all the frustration out of the "floppiness." The Spring U-joint provides sufficient strength to hold even the heaviest sockets without restricting movement of the joint. The actual strength of the spring returns the socket to its original position after being bent or knocked off line. Sidewinder Products Corp., Dept. KC11, 850 Municipal Dr., Hoover, AL 35216, 800/999-3405.



## RUB DOWN

Oxidation can really mar the appearance of a fiberglass kit car. Evercoat's new Boat Armor, a heavy-duty, coarse, fiberglass rubbing compound, is specifically designed for fiberglass and marine metals but should work on a gelcoated kit car body as well. The compound can be applied with either a soft towel or an electric buffer. Boat Armor, Dept. KC11, 6600 Cornell Rd., Cincinnati, OH 45242, 800/729-7600.



## ALTERNATIVE ALTERNATOR

Stinger's High Performance Electrical Accessories offers a new Custom Pro Series line of high-performance alternators. The line features heavy-duty, oversized rectifiers, computer-balanced rotors, and hand-wound stators which meet the demands of competition systems. These units are available in 150 or 200 amp, with single or dual outputs. Stinger High Performance Electronic Accessories, Dept. KC11, 13160 56th Ct., Ste. 508, Clearwater, FL 34620, 800/477-2267. **KC**



## RUST REMOVER

If your donor car has some surface rust, try Restomotive Laboratories Metal-Ready Rust Remover & Primer. This product also helps remove rust for chassis painting preparation. Restomotive Laboratories, Inc., Dept. KC11, P.O. Box 1235, Morristown, NJ 07962-1235, 800/457-6715.

# KIT TECH

By Jim Youngs

## KELMARK KRUSADE

Help. I'm looking for a 10-year-old assembly manual. I recently purchased a Kelmark GT on an old VW chassis, but the assembly manual did not come with it. Does anyone know where I can get an assembly manual? If not, can you put Van K. Hursey of Durham, North Carolina, together with me? Your Show-Off department ran a picture of his completed Kelmark GT in the May '95 issue of Kit Car. I called directory assistance, but he apparently has an unlisted number. I know I can assemble this car without an assembly manual, but it would make it a lot easier if I had one.

John Blakley  
P.O. Box 1441  
Hollywood, CA 90078

I recently bought an early-model Kelmark GT that a neighbor built. When I purchased it this year, it had rusted floorpans, no wheels, no weather stripping, and an '85 registration tag. I wish you



would do a special article on the older kits other than Cobras, GT40s, and \$75K kits. Like maybe VW kits. There are a lot of them still around, and you can't beat the insurance rates.

Robert Bozeman  
Albany, GA

I just bought an older Kelmark body minus the engine, storage compartment lid and glass, roll-up windows, dash, and literature. So I have little idea what type of VW floorpan I need or what factory parts are available. I recently saw an ad in the September '92 issue of Kit Car indicating that the Kelmark molds were for sale. I just spent half a day and quite a few phone calls trying to track down this company but had no luck. I sure would appreciate any help you could give me in locating this company or someone who might still carry the body parts and literature I need.

Rod Anundi  
Albany, OR

We seem to have opened the floodgates recently with regard to Kelmark cars. The bad news is that Kelmark no longer exists; the good news is that Dave Williams just formed the Kelmark Owners Group (Dept. KC11, P.O. Box 181, Jacksonville, AR 72078) and seems anxious to get something started for helping owners find literature, parts, and information. We mentioned once before, too, that Clarke Peters (Dept. KC11, P.O. Box 876, Janesville, CA 96114) has a full set of literature that he received from Kelmark Engineering in 1974 and is willing to share. Another good source of information is local clubs, where someone is sure to own one of these cars and would be willing to help.

Apparently, the Kelmark doors and window glass were hung and fitted at the factory, so finding a glass source will be difficult. The cars were mounted on uncut VW Bug pans, utilizing the stock holes for mounting the body. None of the donor car controls had to be moved or modified.

As for those of you who mentioned a lack of low-priced kits and VW-based kits, you aren't reading the magazine closely enough. We refer you to "Tequila Sunrise" (March '95) for a handsome VW-based sport coupe; "The Price Is Right" (May '95), in which both inexpensive kits and VW-based models were covered; and "Great Pretenders" (July '95) for low-buck exotics (not to mention the cover feature in this issue). Stay tuned for even more in the next two issues.

## ABS ADD-ON

I am thinking about installing ABS brakes on my kit. Can this be done? Is there a kit? Can such a system be adapted from existing stock vehicles? I am staying with a VW chassis and adapting Corvair drivetrain components.

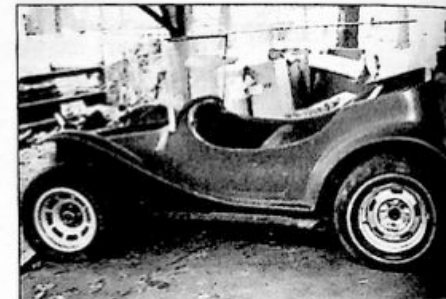
Rick Salisbury  
Lebanon, OR

Whether or not adapting a newer stock vehicle's ABS is doable would surely depend on weight, specifications, brake size, tires, and any number of other factors of your vehicle. These systems utilize wheel speed sensors, electronic control units, and special master cylinder valve bodies to accomplish their stopping tasks. They are backed by thousands of hours of engineering and testing for specific applications. It may not be worth the headaches and fabrication necessary to adapt such systems to a kit

car chassis. Keep in mind that the best ABS of all is an alert driver and a sensitive foot on the brake pedal. There are a couple of aftermarket companies, however, that offer nonelectronic antilock brake control systems. We have not evaluated them firsthand, though some of our friends in the Cobra manufacturing segment report impressive results. For more details write to ABS/Trax (Dept. KC11, 99 Sherwood Ave., East Farmingdale, NY 11735) or Pangra Enterprises (Dept. KC11, P.O. Box 8417, Philadelphia, PA 19101, 610/358-1919).

## MYSTERY T

I am currently restoring a fiberglass car. I have no idea what body style or model it is. I have enclosed pictures of my car in hopes that you will recognize it and tell me something about its history. I will be taking



more pictures of it during the restoration process and hope to have it featured in your magazine when it is completed. The body is currently mounted on a '71 Corvette frame that has hinges on the back to lift the body up like a Funny Car.

Tom Nichols  
Hammond, IN

Somewhere in the dank, dark recesses of our memory banks of trivial infor-

mation, we seem to recall something resembling the photos you sent. As we remember it, however, it was a stylized T-bucket aimed for a VW pan with some cute anonym such as T-Budget. We don't recall a 'Vette chassis in the scenario, but that doesn't mean anything. Details such as the manufacturer, name, specifications, and origin escape us. Maybe some of our readers can help.

## REFERENCE BOOKS

While reading a recent issue, I came across some books that I am very interested in: High-Performance Wheel and Tire Handbook by Jim Horner and Auto Math Handbook by John Lawlor, both from HP Books, and Chassis Engineering by Herb Adams. Could you please give me the addresses where I can order these books?

Louis Denobile  
Quebec, Canada

HP Books is a division of Berkeley Publishing, Dept. KC11, 200 Madison Ave., New York, NY 10016, 800/631-8571. You can reach Herb Adams at Dept. KC11, 23865 Fairfield Pl., Carmel, CA 93923, 408/649-8423.

## CARLESS IN L.A.

I live in downtown Los Angeles. I picked up your mag for the first time, and I was hooked. Is there a kit car classified in the LA County area? I don't want to have to stress myself out trying to build one. Anyway, can you publish something on the Chrysler LeBaron donor car? Picking up your mag, I learned new definitions—"stretched," "donor car," and so on. I'm 19 years of age, and I don't know a damn thing about cars and parts. Is there a book that explains about intake manifolds and all of the other terms I need to know? I am going to purchase a car soon enough.

Arvin Cisco  
Los Angeles, CA

Let's get this straight—you're 19, living in Los Angeles, don't know anything about cars, and don't own a car? Are you a recent transplant, or have you been spending your free time in Northern California hugging trees? You picked a good place to start your automotive life, however. We'll do what we can to guide you through. Yes, there is a classified advertising publication, but it's not in L.A. You can surely find a specialty car trader publication at places where car folks gather, such as 7-Eleven. Otherwise, order a copy of Kit Car Classifieds by calling Westwood Publishing at 610/896-3952 extension 14, and have your credit card ready to charge the \$15 for a one-year subscription. This company also

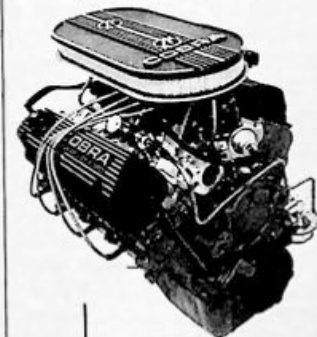


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# KIT TECH

offers a video you might be interested in called The Complete Kit Car Buyer's Video Guide. You haven't been reading long enough to know that we have already published stories on cars built on the LeBaron, specifically Jovi's Autobahn Crüser (May & September '95) and Frank Villaseñor's Kanchin (in this issue), both Benz SL 500 convertible replicas. To learn about things automotive, we suggest you get a copy of Motorbooks International's catalog. Then you can trip through the thousands of automotive books to find just the right ones that will help you with your car education.

## KIT SCHOOL

I am an automotive instructor at Mamaroneck High School. For one of our advanced class projects, we would like to consider building a kit car. To this end I have purchased a subscription to your magazine. I would like some information about building a kit car that would result in a dune buggy vehicle. In your magazine I didn't see any addresses that we could write to for more information. Could you provide me with some sources to begin this project? I realize that many dune buggies are built on VW chassis. I wonder if there is some manufacturer that specializes in using a small-block V8? Thank you for your time. Just a note, we have about 60 students enrolled in our program.

Myron Tannenbaum  
Mamaroneck, NY

Wow, about all we got to do in high school auto shop class was flush the radiator and change the oil on the teachers' cars. We know of at least one other high school auto shop program that built a kit car, and it was a rewarding experience for all involved. You are correct, most of the dune buggy projects are VW-based, but that doesn't mean you can't couple some Detroit iron to a suitable transaxle. There are plenty of adapter kit and transaxle mavens around to help with such a conversion. Contact Kennedy Engineered Products (805/272-1147) and Renegade Hybrids (909/307-2150). As for dune buggy kits, call Fiber-Jet Industries (916/783-3198) and The Buggy Company (916/722-8989).

## SPLISH SPLASH

I was reading your articles on fiberglass repair and building molds, and I had to write to you about a thought I've had. I have heard about companies that have

built rebody designs like the old beach buggies of the '60s, only to have someone pull molds from them and produce and sell cars as their own designs. I just think that it's a lot of work to design something when someone comes along and just copies it. Is there any protection or patent? If so, let me know because some friends of mine were thinking of doing something new for older donor cars.

David McQueen  
Oakland, CA

The process to which you refer is called splashing. Some states carry anti-splash laws on the books, but history has shown that it is difficult at best to prove something has been copied. In the kit business splashing is rather rampant and is the basis for some products. If you ask some Cobra replicators where their molds came from, they will tell you they were pulled from an original car but improved as well. A lot of us in the kit biz seem to live by the adage that plagiarism is the most sincere form of flattery. In some cases auto companies have patents on the designs and will pursue those who infringe. Ferrari is a classic example, having sued several kit operations producing F40 replicas.

## MASTRETTA UPDATE

Is there any upcoming coverage on the Mastretta kit? That is one beautiful-looking car. You certainly are my favorite magazine. Keep up your outstanding work!

Jeff Araujo  
Tewksbury, MA

We agree with your attraction to the Mastretta. We recently revisited the Mastretta families in Mexico City and got to see the second finished car and three chassis in the works. They are currently



looking for some good dealers in the United States, and we've just heard the exclusive U.S. importer is Ed Doherty (Bold City Motors, Inc., Dept. KC11, 252 E. 8th St., Jacksonville, FL 32206, 904/355-9030). Mexico's devastated economy has slowed the Mastrettas down a little, but not their unbridled enthusiasm. Yes, we will be publishing a follow-up feature on the Mastretta in an upcoming issue, along with some other very interesting kit cars built in this teeming south-of-the-border city.

## BASIC QUESTIONS

I have recently become a subscriber to Kit Car and a kit car fan. At present I am not in a position to purchase a new car. If possible, however, could you answer a few simple, basic questions? Are the amounts quoted for kit cars and combo packages usually paid in a lump sum or in installments?

I would like to see a kit car show firsthand. Are they ever in or around Texas?

I am a complete auto mechanic novice. How many tools or gadgets would I have to buy other than a hydraulic engine hoist and stand?

In Texas many of our neighborhoods have speed bumps put in to deter speeding in residential areas. My main concern in noticing your kit cars featured in the magazine is that they look so low to the ground. Being so low would surely cause them to self-destruct upon contact with our speed bumps. Can you give me an idea of how high their skirts are off the ground, specifically the Cobra and Viper look-alikes?

Robert Finley  
Austin, TX

It varies from company to company as to how prices of kit cars must be paid. Some companies require a deposit, then the balance once the kit is delivered. Some allow you to charge it on a major credit card. Still others have financing available. There are kit cars shown held in Texas and Oklahoma, and we suggest you contact Specialty Car Association of Texas (817/536-3380) and Oklahoma Kit Car Club (405/360-0645) for schedules of their events. To answer your question about tools, you can never have enough of them. We would forget about a hydraulic hoist and engine stand; you can always rent those special items and other things you won't use every day. We would invest in a good-quality set of mechanics' tools, including socket sets, wrenches, and screwdrivers, and then build from there as the needs arise and your budget allows. Texas speed bumps must be bigger than average. And if you are worried about them, consider that there are a few things that can be done to raise a car to prevent damage, but they would alter the hunkered-down stance the Cobra and Viper are known for. Have you considered other types of kits with a higher ground clearance?

Having a technical problem assembling your kit? Send your questions to Kit Tech, Kit Car, 6420 Wilshire Blvd., Los Angeles, CA 90048-5515. (No phone calls, please. We're sorry, but we are unable to respond directly to inquiries.)

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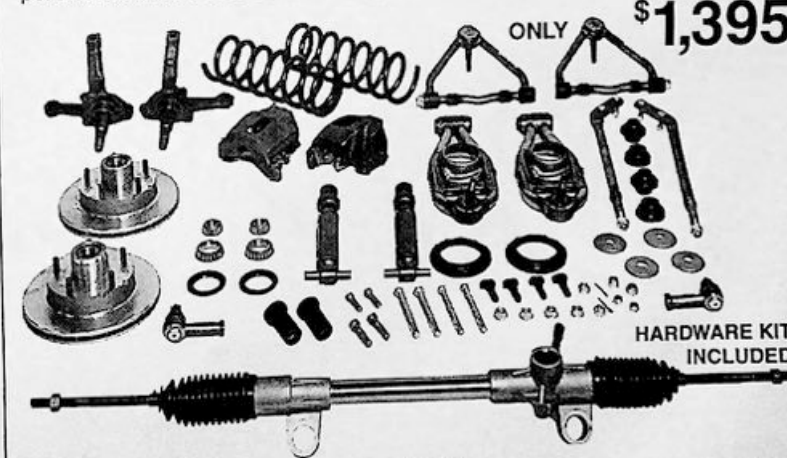
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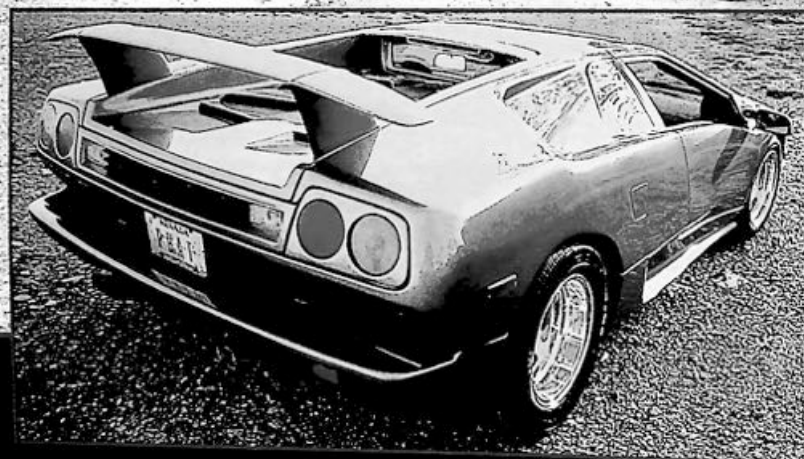
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# Hot Exotics— AT COOL PRICES

By Jim Youngs & Steve Temple

*Exotic.* It sounds so alluring—exotic islands, exotic food and, particularly for us, exotic automobiles. Unfortunately, exotic has the same prefix as expensive, especially when you're talking about cars. Fortunately, kit enthusiasts have found a way under this hurdle with a little ingenuity and lots of resin and glass fibers. So what we have here is a primo selection of vehi-

cles that only *look* exotic and expensive. In this case it's okay to ask how much it costs because you *can* afford it.

One warning, however: This imitation affluence can be addictive. You'll probably want to surround yourself with other exotic-looking objects to dress the part. So plan on wearing a Rolex replica, tinted contact lenses, a clone of Drakkar cologne, and a polyester imitation of an Armani suit. Believe us, nobody will know the difference except you and your accountant.



KANCHIN \$5000

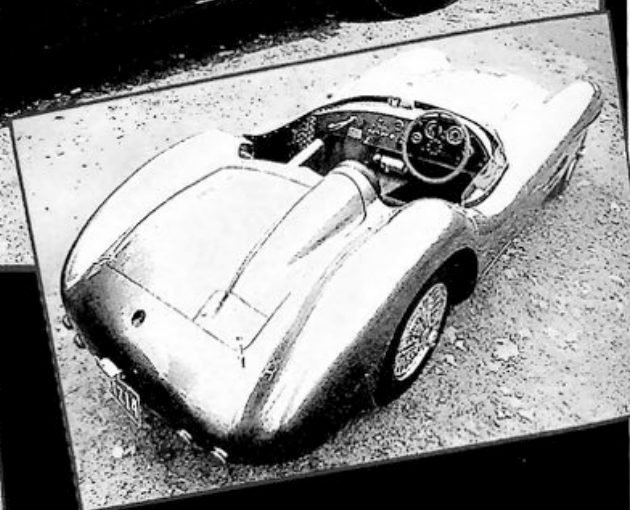
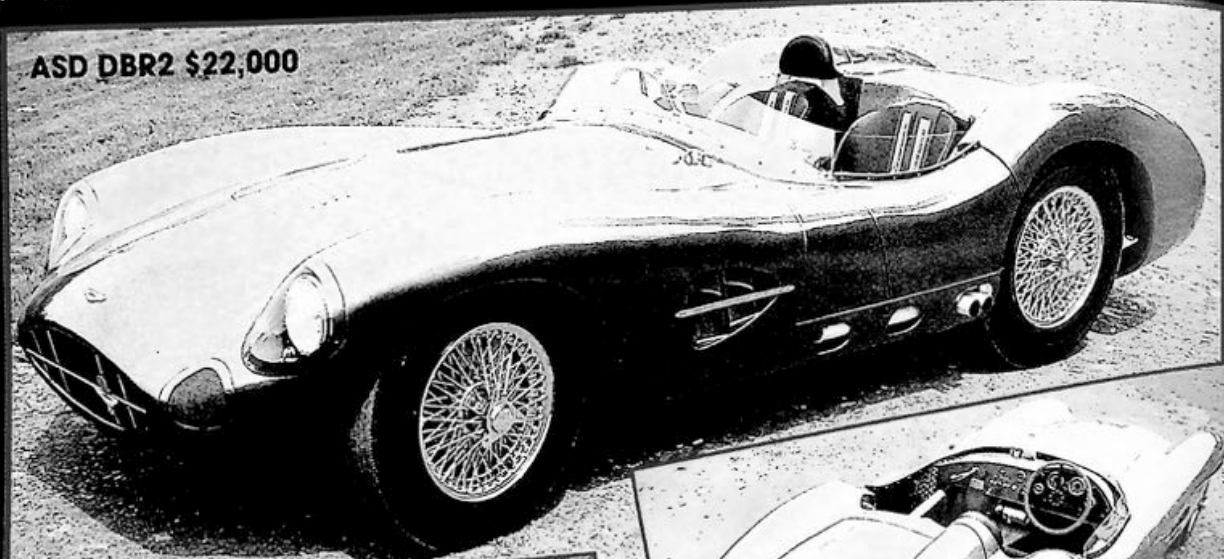


AUTOMOTIVE AFFAIR VORTEX \$7900



# Hot Exotics— AT COOL PRICES

ASD DBR2 \$22,000



D&B ENTERPRISES BARCHETTA \$13,000

## D&R Python & Deceptor

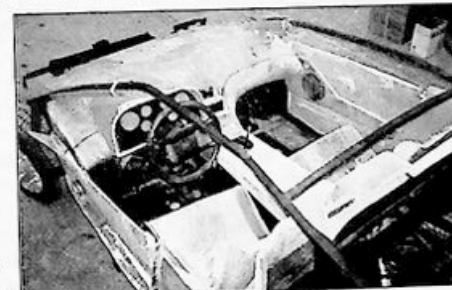
Alluring Lambo Look-Alikes

The versatile Fiero has become the foundation for a mini-industry that contains a dizzying assortment of restyling projects, mostly *faux* Ferraris and Countach clones. The latter have been popular for several years, but the latest craze draws inspiration from a newer Lambo,



the Diablo. We know of a few other similar kits that either are under development or have just been introduced ("Body Double," July '95), but D&R's Python shows a couple of interesting twists. The windshield, for instance, comes from a Pontiac Transport and requires only a bit of trimming to fit. We like this approach because it not only saves money on the initial buildup (have you checked out the price of an original Lambo windshield lately?), but it also ensures easy replacement in the event of chipping or cracking. In addition, D&R has made the twin rear vents functional with electric fans, a feature of particular value for a V8 swap.

Virtually any model year Fiero can serve as the platform, but the top must be chopped, and the frame must be stretched 11 inches. If you don't want to do the chassis surgery yourself, D&R offers this



low for your budget, consider D&R's Countach-style kits, either the 25th Anniversary or the 5000 model—the latter starting as low as \$4495. Both come with the inner and outer doors already hung and the bodies color-gel-coated, another cost savings. Also, the 25th Anniversary-style kit will fit on a stock-wheelbase Fiero with no frame extension necessary. (The wheelwell is positioned farther forward than on the original.) If you find the Countach a little too claustrophobic, an open-top model is available as well. Whatever your preference or budget dictates, D&R is a one-stop shop for modifying Fieros.

### SOURCE

D&R Replicars  
Dept. KC11  
525 Haycock Run Rd.  
Kintnersville, PA 18930  
610/847-2188

## D&B Enterprises Barchetta

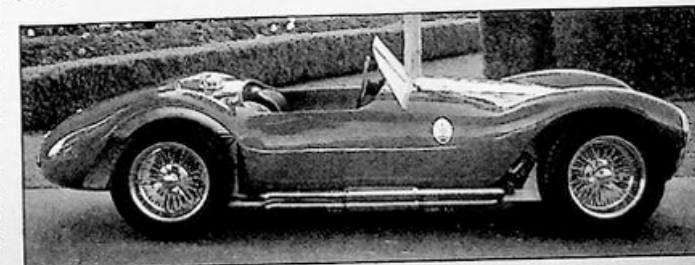
A Sensuous Slice from the Golden Era

To auto enthusiasts, Maserati is just one of those names that evokes a mental trip back to the '50s, the heyday of sports car racing. It was a time when brutish little cars powered by high-strung engines with sweet-sounding exhaust notes blistered now-historic racetracks with formidable performance. It was a no-holds-barred era spawned by a pent-up demand from a world weary from war.

One of the more successful Maseratis in the early '50s was the A6GCS, which won the Le Mans, Targa Floria, and Mille Miglia events of the World Manufacturers Championship against the likes of Ferrari, Jaguar, Alfa Romeo, and Lancia.

Only 64 of the diminutive cars were built, and merely a handful survived the track. Owning a piece of this slice of racing heritage is a privileged opportunity reserved mostly for museums and super-rich collectors. One similarly rare Maserati was reported in recent auto auction results as selling for well over \$200,000.

Such exclusivity is often the impetus for replication—



# Hot Exotics— AT COOL PRICES

not to mention that the beauty of these cars needs to be seen on the road. Darryl Fling of D&B Enterprises found and acquired a set of molds pulled from an original A6GCS Barchetta and decided to build a fairly authentic replica of the car in both turnkey and kit form. The Barchetta is based on a rectangular-steel-tube chassis reinforced by extensive use of sheet aluminum in the body. The front suspension consists of chrome-moly, unequal-length A-arms mounted with Teflon-lined Heim joints; coil-over shocks; and Wilwood aluminum hubs and brake calipers. The rear end is an Alfa Romeo heavy-duty, custom-built racing unit with limited slip, a four-bar and Panhard-rod setup, and Avo adjustable coil-over shocks. D&B uses Chevy spindles with custom knock-offs. This prototype wears Road Hugger P225/60R16 rubber mounted on Dayton custom 16-inch wires.

Although Fling feels a Ford or Chevy small-block V8 might fit with some shoehorning, a 3.5-liter Buick/Rover all-aluminum V8 built by Hydromotive Engineering powers this particular Barchetta. Outfitted with hydraulic lifters, a Crane cam, custom 1.5-inch headers, and balanced and polished internals, this 215 ci develops a healthy 270 hp. Sitting atop the intake manifold is a beautiful four-deuce set of 40mm Dellorto downdraft carbs. The power is delivered to the rear through a Rover five-speed tranny. Exhaust exits the engine compartment through a quartet of polished stainless side pipes with individual inline mufflers for a pleasing, well-tuned, four-part harmony.

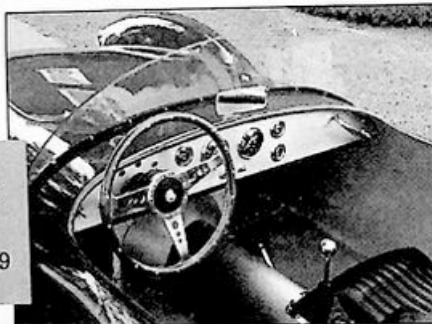
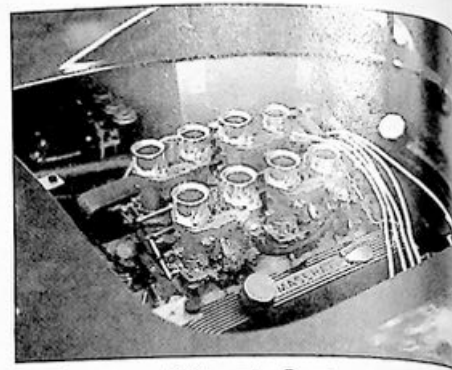
## SOURCE

**D&B Enterprises**  
Dept. KC11  
22711 Hwy. 36  
Cheshire, OR 97419  
503/998-3283

Barchetta's curvaceous body contours are the kind that make vintage-car buffs swoon. Yet the cockpit is all business—the business of racing—with most surfaces skinned in smooth aluminum paneling. The aluminum dash sports a minimal array of Classic Instrument gauges, and a Moto-Lita wood-rimmed wheel handles the helm duties. A pair of vinyl-covered bucket seats rounds out the cockpit amenities.

D&B Enterprises offers a body and rolling chassis kit for \$13,000, which includes the brake and suspension components. Fling plans to also build a very limited number of turnkey cars each year to sell for a minimum of \$45,000.

This is one of those cars that should be delivered with a warning label—not so much for its 1500-pound dry weight and motivated engine, but for its lines, its rareness, and the doubtless fact that few people have ever seen one in person. The label should caution a prospective owner that all eyes will be on him and he will have to tell the what-it-is story at every gas station and stoplight.



## Kanchin

*Frank Fabricates a Fabulous Fake*

Do you ever feel snubbed at fancy restaurants when the valet parks your car way out of sight but places the Mercedes-Benz right next to the front door? Status, perceived or bought, certainly has its privileges, but you really don't have to have a lot of money to attract that kind of attention. Frank Villaseñor of Auto Conversions By Frank (ACF) has developed a six-figure image on a blue-collar budget with a kit that transforms the ubiquitous LeBaron convertible into a high-buck luxo ride that will fool even seasoned valets.

This is the second Teutonic SL replica we've evaluated ("Career Move," September '95), and it differs from the Jovi kit in its approach. Starting with an '88 or newer



LeBaron convertible, ACF's body kit (\$5000) begins the transformation by replacing the front fenders with new fiberglass components. The stock polyurethane bumper cover is removed next and replaced by the new fiberglass bumper cover, which incorporates the lower grille, the lights, and the abbreviated chin spoiler. Unlike the Jovi kit shown in our September issue, ACF's kit does not replace the stock hood. Instead a skin is bonded to it that incorporates the distinctive grille. The headlights, taillights, and grille come from the Mercedes parts bin.

Attaching the one-piece rear clip requires a little more modification than is necessary at the front, but it is not out of the realm of the backyard builder. The rear fenders need to be cut to enlarge the wheelwells for bigger tires. Welding is required to modify the trunk hinges to accommodate the new trunk configuration. The rear bumper cover needs to be removed prior to installing the rear clip, which incorporates a new bumper cover. The rear clip fits over the fenders and is bonded, bolted, and riveted in place. ACF has even accommodated a fuel-fill door that bonds to the existing stock door with no mods needed for the hinge.

At the time we photographed ACF's prototype shown here, the company had no intentions of changing the stock LeBaron doors or rocker panel shape. After displaying the car several times at shows, however, it realized that people interested in this style of car want the full treatment, so it

has added door skins to the kit that bond over the stock doors. ACF is also currently developing a lift-off hardtop and a convertible top boot.

To finish off the project it is necessary to do a little rewiring to graft the new lights into the stock wiring system. Then the rebodied LeBaron is ready for body prep and painting. The car can be further transformed by adding ACF wheel adapters to accept a Euro bolt pattern on custom wheels and wide, low-profile tires. The suspension can also be altered to provide a lower stance. Cutting the coils is the easiest method of lowering the car.

A straightforward rebody such as this makes a lot of sense, and not just from a financial standpoint. LeBaron donors are plentiful and reasonably priced, and some of the models even have leather upholstery, electric windows, and power door locks. The engines and running gear don't have to be altered or touched, and the stock windshield and top are retained. As you can see, you don't have to spend

## SOURCE

**Auto Conversions By Frank**  
Dept. KC11  
1021 S. Blosser Rd.  
Santa Maria, CA 93454  
805/928-8646



\$100K to own an exotic that will get immediate recognition and respect from parking valets.

## ASD DBR2

*One Beautiful Brit Kit From Our Man in England*

Only two Aston Martin DBR2s were ever built. They were successors to David Brown's famous DBR1 that finished First and Second at Le Mans and went on to win the World Manufacturers Championship, the first English car to ever achieve that distinction. The DBR2s were designed to compete on the unrestricted British national scene, where the DBR1's 3.0-liter engine was a handicap, particularly against the formidable Lister Jags of the era.

As English replica builder Bob Egginton of Automotive Systems Development (ASD) sees it, the rareness, \$2-million-plus price tags (on the rare occasion when one manages to hit the auction block), and unmatched beauty of the DBR2s make them desirable even in facsimile form. (Regular readers will recognize Egginton from a number of tech features he has written for this magazine.) This faithfully recreated roadster is a real beauty in form and very authentic in function. The English refer to this as a "bespoke" car, meaning it's a custom-tailored reproduction that can be purchased in component form.

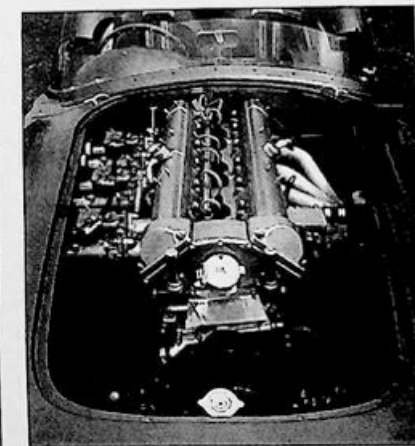
For about \$22,000 (depending on the vagaries of exchange rate fluctuation) you get a painted fiberglass body, a complete chassis, an interior, and wheels and tires—in short, practically everything except an engine

and a transmission. At the Carlisle show last spring we ran across John Stinsman, who had brought his newly finished DBR2 to exhibit on the fairgrounds.

The original DBR2s were powered by 3.7-liter, six-cylinder engines. Stinsman wanted to keep things as period-correct as possible and still have a fairly dependable road-going car, so his DBR2 is powered by a 4-liter DOHC hemi built to Aston Martin Vantage specs. This particular engine is a '69 version of the mill but is significant in that Aston Martin built only about 5000 of them. It is fed by a bank of Webers and churns out 325 hp. Stinsman updated the engine by modifying and fabricating components to use a '75 Chrysler distributor driving off the rear of the cams.

The ASD chassis consists of a space frame with in-house-made front wishbones and coil-overs. The rear is a de Dion system with radius rods, a Watts link, and coil-overs. The differential is from a Cosworth Sierra, although other units will fit as well. Genuine wire wheels with knock-offs are standard and shod with period-correct Avon 16x6 tires.

A pair of leather-covered bucket seats is about the only comfort amenity of the race-car Spartan interior. This righthand-drive vehicle displays many vintage components including the shift gate, wood heel pads, low wind-screen, and rearview mirror. Most of the cockpit surfaces are made of aluminum panel, with just a few touches of machine-turning here and there for nostalgic effect. Only five instruments grace the dash, along with an array of



## Hot Exotics— AT COOL PRICES

electrical switches and indicator lights.

ASD has even reproduced Aston Martin period latches, vents, grilles, catches, and other hardware no longer available. The company also has a long list of optional components to further tailor the car to an individual's whims. ASD can even supply packages in various stages of completion. There is also an aluminum body available at a premium price tag.

## Automotive Affair Vortex Some Refinements and a Really Choice Award

Since we last caught up with the Automotive Affair boys ("Easy Money," March '95) they have been very busy, not only taking orders for their Vortex roadster but also honing and refining this beautiful car. Each time we passed the Vortex display at this year's Carlisle Import/Kit and Replica show, there was a crowd gathered around the stunning yellow version featured in this article. The interest was so high and the car such a standout that it also garnered your editor's Best of Show award, and believe us, the competition was stiff.

Admittedly, the car we photographed previously was the company's prototype, but ongoing development work has produced refinements absent on the first car. Included now is a nicely tailored, top-stitched upholstery piece for the windshield frame. The donor 'Vette's console is disguised a bit more, and the cockpit upholstery treatments are improved. The company also developed a little top that looks no less odd than the one used on the Dodge Viper but follows the any-port-in-a-storm philosophy. Also modified was the exhaust routing to make it easier to use catalytic converters with the side pipes.

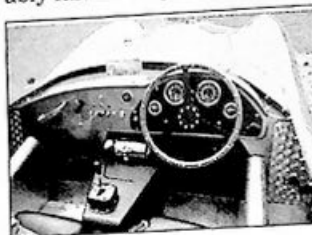
The Vortex kit (\$7900) is designed to fit late-model '84-'94 Corvettes with very little modifications to the donor car. About the only necessary changes to the donor include removing the windshield and the gas tank to be replaced by Automotive Affair's equipment. Of course the Corvette's body panels must also be removed. The donor chassis is otherwise not altered, nor is the engine and drivetrain, emissions system, or suspension.

Automotive Affair has taken great pains in the development of this kit to ensure that everything fits properly. For example, the one-piece rear clip has a steel-tube framework bonded in for proper alignment and to hold the gas tank. The rear clip is also molded to match the rear doorsills to further ensure proper alignment. The front hood and fender portion attaches to the donor's hinges, and the front bumper aligns with the hood and attaches to existing supports. The donor's doors remain hinged and latched but are skinned with composite panels. The inside of the doors also receives upholstered panels with distinctive contours, and the dash gets a new face.

On a degree-of-difficulty scale, the Vortex ranks pretty low with only a little welding required to attach rocker-panel mounting brackets to the chassis. Rewiring is also required to graft the new O.E.M. headlights, driving lights, and taillights to the donor car wiring. If the optional dash panel and Auto Meter gauges are installed, additional

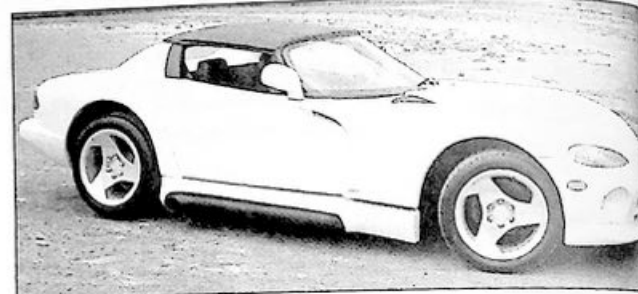
22 KIT CAR

Cars with such fluid grace as the Aston Martin DBR2 need to be seen on the road, not in some museum collecting dust. The economic realities, however, preclude that kind of thinking. It is possible, though, and desirable as well, to achieve the feeling of the '50s with ASD's remarkably faithful replica.



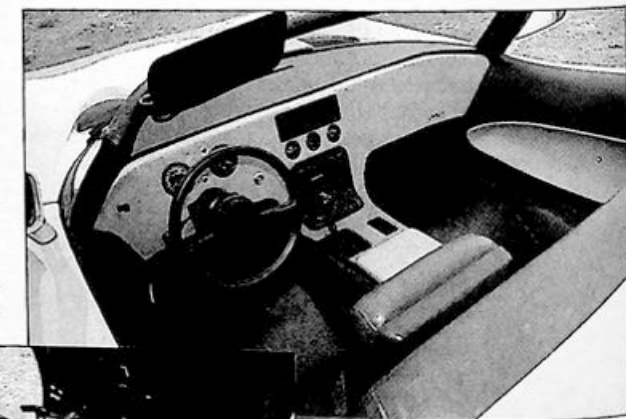
### SOURCE

Automotive Systems  
Development  
Dept. KC11  
Ledian Farm Est.  
Leeds, Nr Maidstone  
Kent ME17 1RZ  
England  
011 44 1622 862195



wiring is required to make the new instruments functional. For the most part, attaching the body panels requires riveting, bolting, and bonding. The donor car seats, cockpit carpeting, and other interior components can remain untouched, or the seats can be re-covered if a different look is desired. Since the Vortex body is wider than the Corvette body, Automotive Affair offers wheel spacers, so 17-inch wheels and meaty 285/35 front and 335/35 rear tires will fill the new wheelwells.

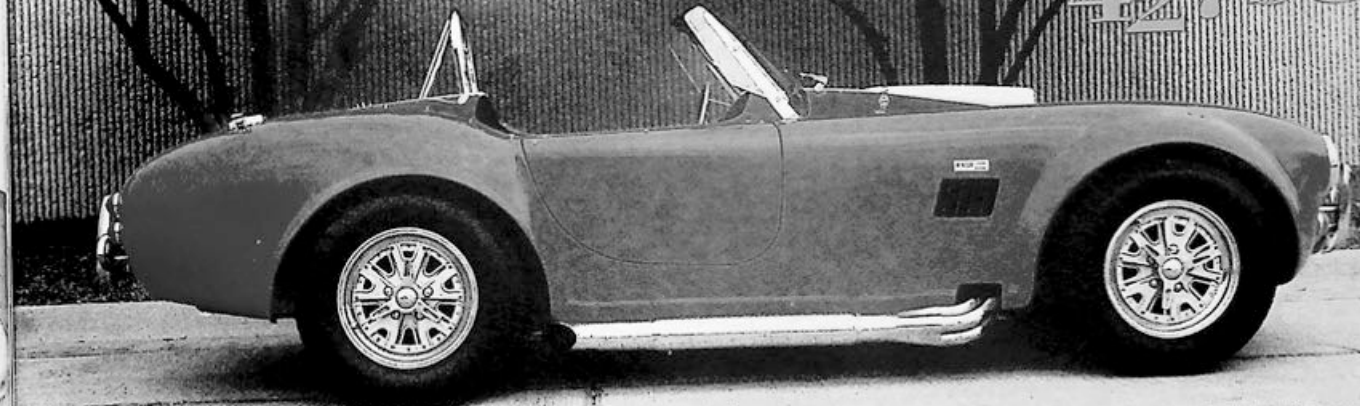
Automotive Affair's Vortex kit promises to quickly put you on your way toward life in the fast lane using one of America's premier performance platforms. And it does so without taking a huge bite out of your nest egg and hundreds of hours of your precious free time. Look for a coupe version as well in the coming months. **KC**



### SOURCE

Automotive Affair  
Dept. KC11  
145-1673 Richmond St. N.  
London, Ontario  
Canada N6G 2N3  
519/473-7070

## What does Car & Driver Magazine say about Everett-Morrison's **Cobra** REPLICA 427SC



### "... the logical way to do a better Cobra..."

"...we have an Everett-Morrison kit designed to accept the current Corvette suspension. Owner Larry Rea of Cedar Park, Texas, built it with his son, Lucas, in ten days."

"Everett-Morrison offers a broader variety of chassis possibilities than any other kit-maker I've found."

"The suspension has the fast, 13:1 power steering and the after-1988 Corvette rear geometry."

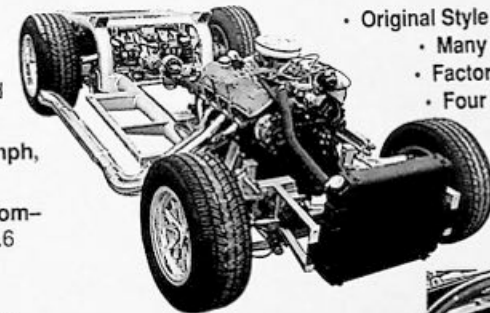
"Braking was exceptionally good at 161 feet from 70 mph, and 1.04g was measured on the skidpad."

"This car holds our record for fastest through the slalom—averaging 71.2 mph (the Nissan 300ZX Turbo did it at 69.6 mph, the old record). Steering response, though, was quicker than lightning."

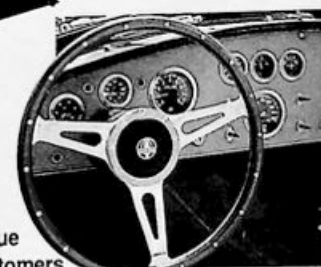
"Everything about the car is skewed in the direction of steering quickness... its light weight, its rear weight bias, its power steering, its short wheelbase, and its low-profile tires on wide wheels. The combination makes a standard Corvette feel as lethargic as a Limousine."

"... the Corvette suspension was more composed than any of the others."

Car and Driver Magazine, December, 1991.



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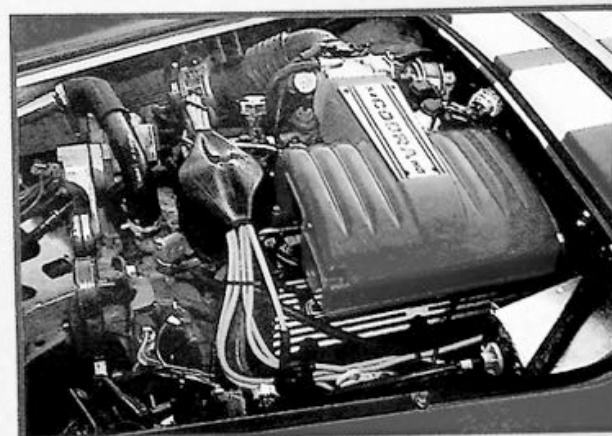
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Harnessing a Mustang to a Cobra Now Costs a Lot Less Than You Ever Imagined, Thanks to Factory Five Racing



# Horse Trader



By Steve Temple

**S**ome of our readers feel the kit car industry has lost its way. Their criticism stems in part from the days when kits were cheap, both in price and quality. While we would hardly want to turn back the clock on the quality of construction, we are inclined to agree about the cost aspect. Why can't a company come up with an affordable Cobra replica that uses a popular and plentiful donor car with some real performance potential?

Mark and David Smith of Factory Five Racing (FFR) of South Dartmouth, Massachusetts, asked the same question about five years ago and decided to apply their Yankee sensibilities and considerable technical training to find an answer. What they've come up with has been cleverly hidden in plain view: the fuel-injected 5.0-liter V8 Mustang. With well over a million produced since 1987 and a significant portion of them now languishing in salvage yards, ponycars are ripe for the picking. Not only that, considering all the performance components being developed, some aftermarket engine companies are hailing Ford's 225hp 5.0-liter V8 as the small-block Chevy of the '90s. (We can just see the Bow-Tie types gagging on this statement, but we'll set aside that debate for another time and place.) However you view the 5.0 Mustang, there's certainly more than enough of them to go around. So why not design a Cobra kit around it?

Why not indeed, because that's exactly what the brothers Smith at FFR set out to do, and judging from the test

mule we recently checked out, these guys are onto something big. Let's cut to the literal bottom line: The kit price, not counting the Mustang donor prices, runs only \$9900. Throw in another \$2000 to \$3000 or so for the Mustang pieces from a salvage yard, and you've got a Cobra replica kit that runs less than \$13,000 total (not counting body prep and paint, which could run as little as \$1000). Of course, the buildup cost would be even less if you've already got a ponycar carcass in your backyard that can be picked clean (see inset box for a detailed listing). If you're not into wrenching on the kit yourself, a turn-key vehicle with a stock 5.0-liter starts at only \$22,000.

We've noted a few other Cobra replica kit prices in the same ballpark, but many of them offer only a barebones package without the "options" necessary to complete the buildup. Moreover, most Cobra kits have not been specifically engineered for the emissions system of the 5.0-liter, a point of increasing concern in some states. Usually, Cobra kits start at a price in the mid to upper teens, and that's without an engine and tranny. Sonny Sylvia, one of FFR's first customers and the owner of the red demo car shown here, put it succinctly: "I've always wanted a Cobra replica, but this was the first one I could afford."

Of course, big-block Cobra fans will scoff at a 427 body style with a small-block under the hood. And they'll also be quick to point out that the resale value will be much lower for a small-block Cobra replica. Yes, that's generally true, but the point is you don't pay as much up front either. In fact, the cost of a dressed-out 427 side-oiler is about the same as FFR's entire kit. And there are

# Horse Trader

far more potential customers who can afford a small-block Cobra and would be tickled pink to drive this around town.

Like us for instance. Our Vericom performance computer measured a 0-60mph time of 5.34 seconds on BFGoodrich T/A radials. That's quicker than 98 percent of the cars you'll pull up next to at a stoplight, and as already mentioned, there's

now a whole host of go-fast goodies to upgrade the output of the 5.0-liter. We've already put in a request to road-test a special edition with, let's see, GT-40 heads, a Paxton blower, a stroker kit, or even a 351W. The only weak link in the drivetrain with a hopped-up 5.0-liter would be the stock T5 tranny, but hard-core 5.0-liter enthusiasts already know about swapping it for a Tremec. One of the

main reasons FFR's Cobra does so well with the standard powerplant is the feathery 1850-pound weight of the car, due in large part to a thinner, unstressed fiberglass body mounted on the subframe. Also, extensive use of aluminum instead of 'glass for the inner panels shaves off unwanted weight. These changes alone are worth about a 400-pound savings, and as a result the car has a lithe, agile feel.

Considering that the suspension and brakes were designed for a much heavier vehicle, it's no surprise they are tough enough for Cobra duty. From 60 mph we stopped in 144 feet,

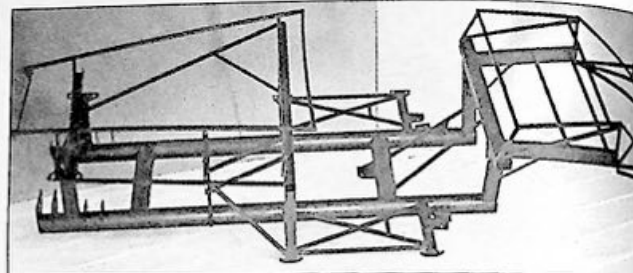
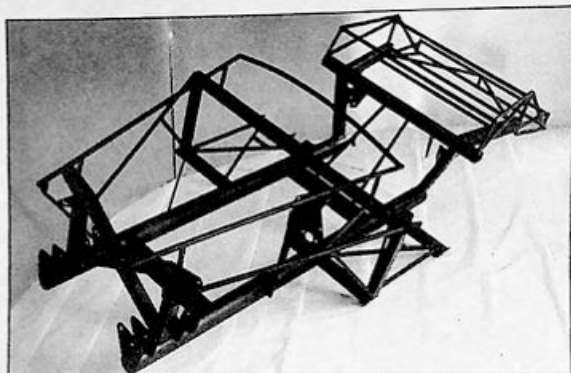
and we could probably improve on that with some more seat time. The front suspension is not a total transplant, however. FFR supplies custom, tubular upper A-arms with a patented ball joint for converting the strut spindle to a double-wishbone setup (the Mustang's strut towers are too tall to fit under Cobra fenders). Also included in the kit are Carrera adjustable coil-overs. Otherwise, the front end retains the Mustang's spindle, brakes, and lower A-arm with its low-friction ball joint. (Incidentally, FFR claims this ball joint offers much

less resistance than the Mustang II's for better ride quality.)

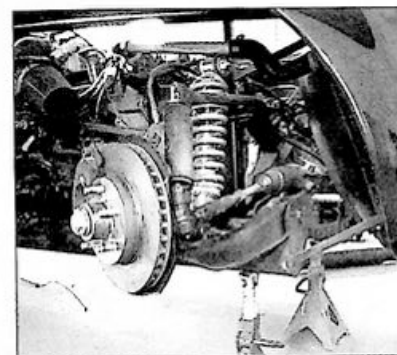
The 8.8-inch live axle also has a couple of mods: To account for the reduced weight of the Cobra, 2½ coils of the rear spring are sawed off the top. Also, a bracket is attached to the lower trailing arm's anchor (see detail photos). This bracket preserves the antisquat geometry of the four-link rear end while allowing the body to sit low like the original car (live-axle Cobra replicas tend to ride high in the rear, but not this one).

The brothers Smith were quick to

point out that the test mule is a bit rough in spots—the molding on the cockpit coaming is being reworked, the seats are a copy of the Daytona Coupe's rather than the 427 roadster's, and the pedal positions need some adjustment. Also, in response to our suggestion, future models will not have rivet heads on the doors for affixing the aluminum inner panels. Niggling criticisms aside, what we have here is *proof of concept*. The car is real, it works, and it's one heckuva deal. Any way you look at it, that makes just plain, good horse sense.



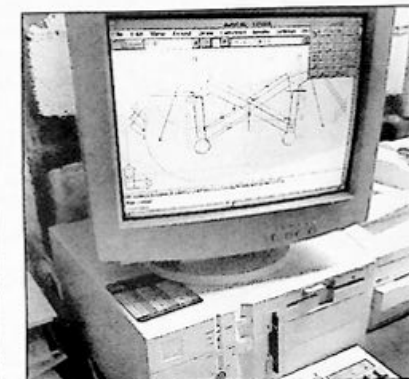
The kit's frame consists of two 4-inch round-tube main rails with two crossmembers, a vertical X-member to anchor the front suspension, and a subframe consisting of ¾-inch and 2-inch box tubing.



While the lower A-arm, spindle, and brake assembly are stock Mustang pieces, Factory Five's kit furnishes the coil-over, upper A-arm, and patented ball joint.



The kit includes aftermarket catalytic converters and elbows with oxygen sensors, all mounted between the exhaust manifold and side pipes.



Factory Five developed much of this kit on a computer with AutoCAD and database software.

## PICKING PONYCAR PARTS

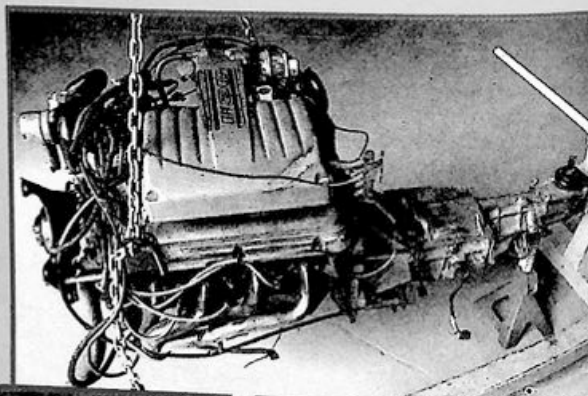
The list of items required from a Mustang donor to complete FFR's Cobra kit is too long to print in detail (about 68 components in all), so we'll try to give you a general outline of what you'll need. Technically speaking, parts from earlier Mustangs will work, but the '87 and later models are recommended because the engine has more horsepower, the rear end is stouter, and the brakes are larger. Even better are '89 and newer engines because the Mass Air Flow sensor can better accommodate all of the new performance parts now available.

Whatever model year you choose, starting from the front, you'll have to unbolt the radiator assembly, steering rack, and front struts. The upper section of the strut must be removed and the spindle fitted with FFR's upper A-arm and patented ball joint. The brakes, flex line, and master cylinder are stock Mustang items, but the steel lines and fittings are already attached on the Cobra chassis. Mustang fan-style wheels can be used, and they really don't look that out of place on a Cobra. (For a more authentic look, P.S. Engineering makes six-spoke imitation pin-drive units that fit the stock hub carriers, as seen on the red demo car.)

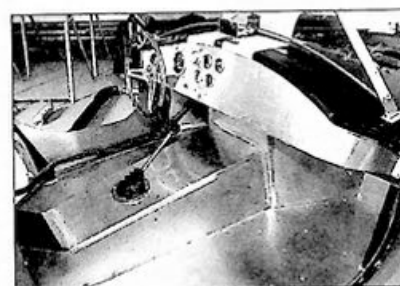
Of course, you'll also have to yank the engine and assorted accessories, along with the transmission and mounts for both. The exhaust system is stock, but the shorty headers are swapped to the opposite sides of the block and are run forward to catalytic converters included in FFR's exhaust system (which also includes side pipes and elbows with oxygen sensors). Electrical items, from the computer unit to the lighting system and even the horn, are all cannibalized. Interior items include the pedal assembly and gauge cluster (FFR supplies a gauge conversion kit).

Moving farther aft, the driveshaft must be shortened to 10½ inches flange to flange. The Mustang's high-pressure fuel system and tank are employed, including the filler-neck cap that's neatly concealed under a Le Mans-style cap. (There's plenty of room in the engine compartment for the evaporative-fuel canister.) All of the 8.8-inch rear end's suspension arms are used with the required mods already mentioned.

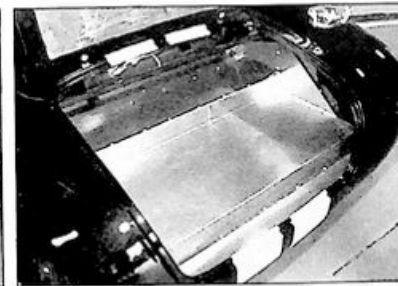
If you don't plan to part out your old 'Stang, all of these components are readily available from a Mustang-oriented salvage company such as Menard Automotive Sales. Proprietor Rick Menard quotes a figure of \$2000 to \$3000 for the whole shebang, depending on the year and mileage.



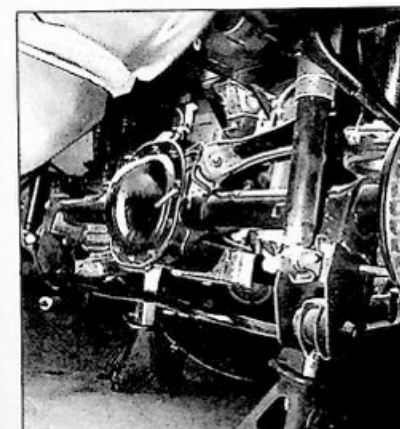
**SOURCE**  
Menard Automotive Sales  
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Chester, NH 03036  
603/887-4049



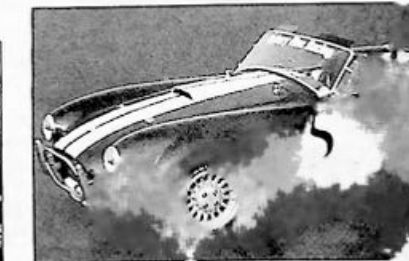
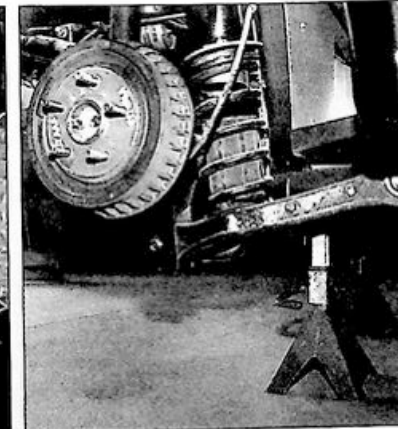
Liners for both the cockpit and trunk are computer-cut for accuracy out of 6061-T6 aluminum, which saves weight over conventional fiberglass liners.



Concealed underneath the Le Mans-style gas cap is the stock Mustang filler-neck pressure cap.



Note the extender brackets on the outboard ends of the live axle. These maintain the proper angle on the trailing arms for antisquat geometry while allowing the body to sit lower on the frame.



If you're really on a tight budget, the Mustang's fan-style wheels go pretty well with a Cobra body. **KC**

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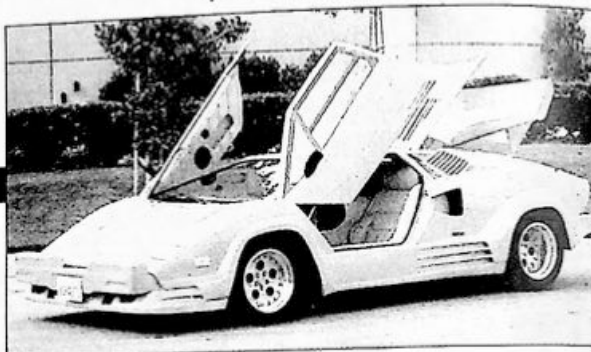
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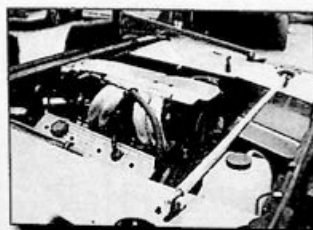
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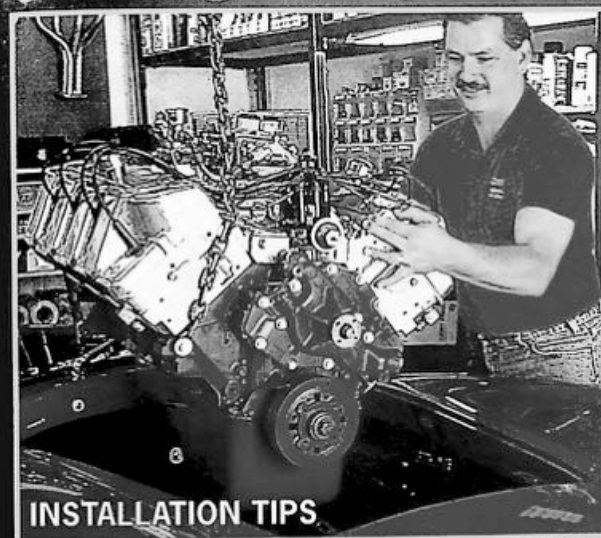
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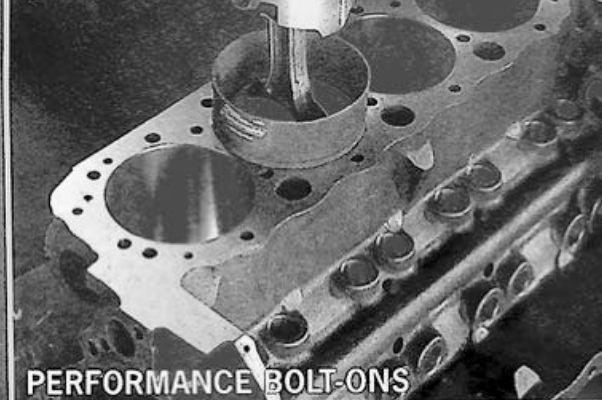
## INSTALLATION TIPS

## A New Section for Kit Builders Installing and Upgrading Their Drivetrains

Whether you're just thinking about building a kit car or you've been driving one for several years now, one thing you've gotta have is power—preferably lots of it, because a kit is just a pile of parts without a good engine under the hood. Some of the most potent and innovative powerplants seen anywhere go into project cars, because kit builders are a creative bunch who like to do things differently—that's why we build kit cars in the first place.

For these reasons, *Kit Car* is introducing Engine Tech, a new 10- to 15-page section running in every issue with hands-on and how-to info specifically for kit enthusiasts. Most kit cars use V8 engines, so we'll be emphasizing them, but you'll also see tips on V6s, four-bangers, air-cooled VWs, and rotaries. We'll be covering everything from air cleaners to oil pans, carbs to exhaust manifolds, and radiators to rearend ratios, all with the kit builder's special needs in mind. We'll show you how to save money and how to spend it in the most effective way. No other source on the planet will provide you with as much specific assistance on hooking up and improving your kit car's drivetrain.

Articles in coming issues will include top 10 engines for kits, fuel-injection conversions, building the ultimate Cobra motor, trick engine swaps, Chevy high performance, and buyers' guides to engine kits and parts. We strongly encourage readers to write to us with questions on all sorts of engine subjects, because these will not only be answered in Engine Q&A, but they will also help inspire tech articles. So whatever your needs for speed, let us know—we'll show you where to get the parts and how to bolt them on.



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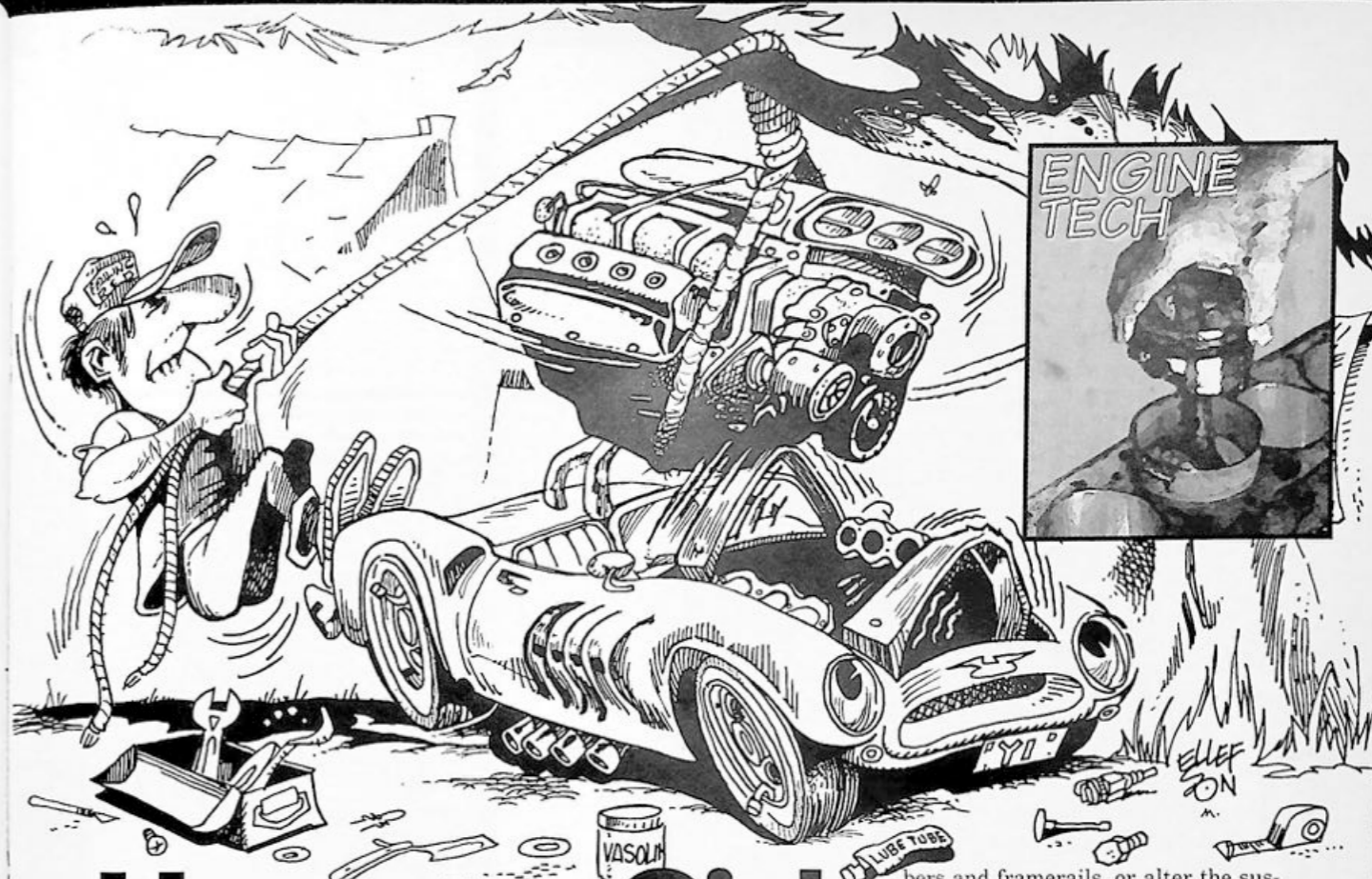
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# & WHITE HOT



## How to Pick the Right Engine

### Getting It to Fit Is Only Half the Battle

By Steve Temple

**A**bove and beyond the challenges of building a kit is a decision that can be just as difficult: what to put on the other side of the firewall. Granted, if the only option is using your '52 Nippy's twin-pot eggbeater, then read no further. But if you're scratching your head about choosing a small- or big-block, a Bow-Tie or Blue Oval, or a turbo V6 or plain-vanilla Volkswagen, then we've got a few tips for you.

### One Size Doesn't Fit All

We don't really need to point out that kit manufacturers should be your first source of info on engine

selection. Yet occasionally we find that some companies will say a big-block V8 fits into their products, and it really doesn't (at least not without some chassis modifications). Or a later-model, fuel-injected mill will "plug right into" the kit's harness, and it actually won't (unless you rewire the dash). So it's a good idea to check out a specific engine application firsthand, especially if the engine is a bit out of the norm.

Basic dimensions of height, width, and length are not the only concerns. Anything that protrudes from the block—starter, fuel pump, oil filter—may cause clearance problems. We've struggled with kits in which items such as the alternator mount, oil filter, distributor cap, spark plugs, exhaust headers, and the like get in the way as well. A big engine isn't always the answer, especially if you have to reshape the footboxes and fender panels, modify the crossmem-

bers and frametrails, or alter the suspension and steering. Time and money expended on stretching the envelope might be better spent on massaging a mill that fits more easily into the compartment. Thanks to advances in engine technology, a stout V6 or a DOHC 16-valve four-banger may furnish all the power you need and drop right in between the frametrails.

If you've gotta have a V8, though (and we certainly understand why), the small-block Chevy 350 is one of the "cleanest" power packages with few annoying protrusions and hence is a favorite among kit builders and engine swappers. Also, if you're planning an East-West (transverse) installation, such as in a Fiero donor car, the Chevy is about 1½ inches shorter than a 302 Ford. On the other hand, the Ford is about 1½ inches narrower than a Chevy. Whichever you choose, there is an abundance of bolt-on performance parts on the market to boost output of both these small-blocks to big-block levels and above without the weight penalty.

Occasionally, a simple mod such as changing an oil pan to either a front- or rear-sump type or using a remote oil filter mount can help you shoe-horn in your mill of choice, but don't take anybody's word for it until

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NOVEMBER 1995 33

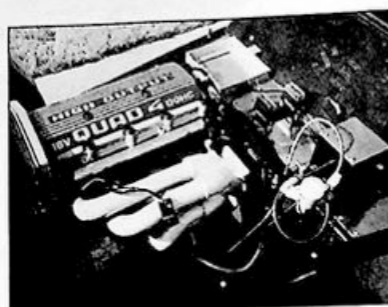
# How to Pick the Right Engine

you've either seen the engine installed in that particular kit or you've supplied the builder or manufacturer with *all* of the relevant dimensions.

## Mount and Ride

Something as simple as engine mounts can make a big difference in both fitting the engine and the ride quality. The two sidemounts near the middle of the block should be the rubber-cushioned factory units for the engine (not the donor vehicle). We don't recommend using front-block mounts with rear-transmission mounts, because this setup places too much stress on the bellhousing. (Use bellhousing mounts with front mounts.) If you need to do some custom tailoring in the compartment to wedge in the engine, first attach the factory brackets and rubber mounts to the engine and trans, position the assembly in the kit chassis, and then fabricate new brackets or crossmembers to mate with the mounts. If you must use a motor plate or other solid block mount, sandwich a rubber biscuit or at least a polyurethane bushing between the mount and the frame. Otherwise, all engine vibration and torque will be transmitted to the chassis, which not only will rattle your teeth but can also crack the frame and fiberglass body.

Where should you mount the

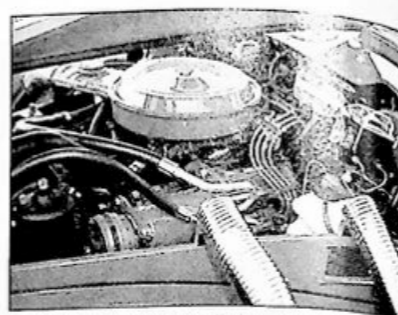


Engine technology has come a long way in recent years, so a DOHC Quad 4 may have all the beans you'll need for a lightweight kit such as this Westfield replica of a Lotus Super Seven.

engine? Clearance is the common-sense approach. You want it high enough to clear the ground, low enough to clear the hood, basically centered between the framereils (though offsetting it 1 or 2 inches to



Before investing heavily in a built motor, don't forget the domino effect on the rest of the vehicle.

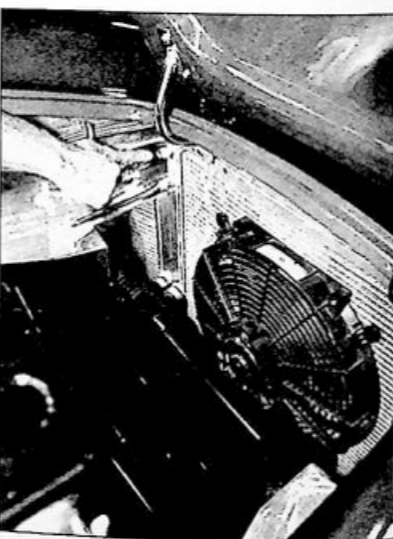


Getting an engine to fit into the compartment of a replica such as this Heritage 500K can be a tight squeeze. Check not just the overall dimensions but various protrusions such as the water pump, alternator mount, and oil filter.

the right to clear steering is admissible), and far enough back so there isn't too much weight at the front of the vehicle (no more than 60 percent of vehicle weight on the front wheels). When your project car is finished, the engine should be level with the ground so that oil, gasoline, and trans fluids will sit (and measure) properly in their respective reservoirs (especially the carb float bowls).

## Domino Effect

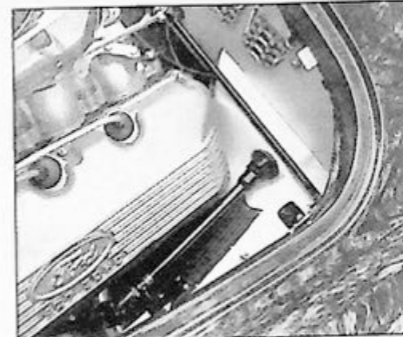
What level of horsepower and torque your kit engine should have is a subject for an article in itself, and we'll be addressing it in greater detail in future issues. For now, we should mention some general guidelines. We will assume that your kit car is for street use, with typical engine operation ranging from 1500 to 2500 rpm through 5000 to 6000 rpm maximum. A peaky, high-



High-horsepower engines in kit cars require special attention to cooling. Contemporary Classic's Cobra replica uses an aluminum radiator with extra-large 1 1/4-inch tubes, a bleeder screw, and an electric fan.



For optimum performance, positioning is as important as power output. This 5.0-liter is set way back against the firewall for better balance.



Wedging in an oversized engine, such as this 427 Cammer (SOHC) in an ERA Cobra, requires mods to the footboxes and fender liners, along with the spring rates.

## COBRAS: SMALL- OR BIG-BLOCK FORD?

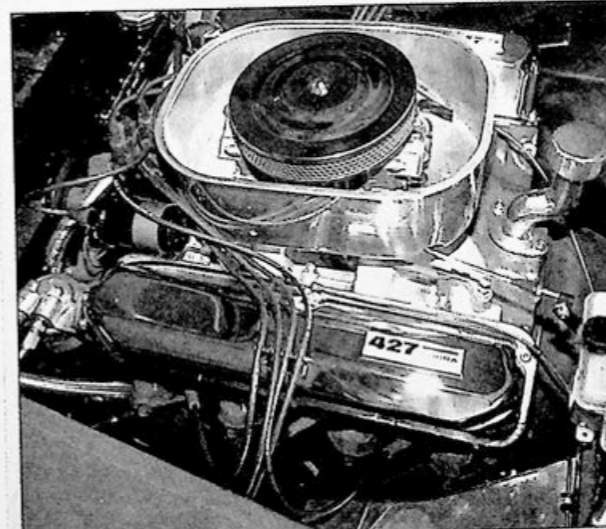
For Cobra fans, deciding on small-block versus big-block—and then which type within these categories—can be a daunting task in itself. Depending on a given Cobra replica's body style, there is a historical basis for using everything from a 260 to a 428 and even a twin-turbo version (just ask Bill Cosby about the latter). Most Cobra roadsters have the 427 body style, but for those that don't (either a 289 FIA or the slab-sided street model), Ford's 289, 302, 5.0 EFI, and 351 small-block V8s are sensible choices and may result in a more balanced feel and better handling, depending on the particular replica. (On the original Cobra, Carroll Shelby and many of his drivers, such as Bob Bondurant, favored the lighter-weight 351 block for roadcourse racing, but Ford wanted to promote the 427 so that's what ended up between the framereils.)

Today, the more established Cobra repli-

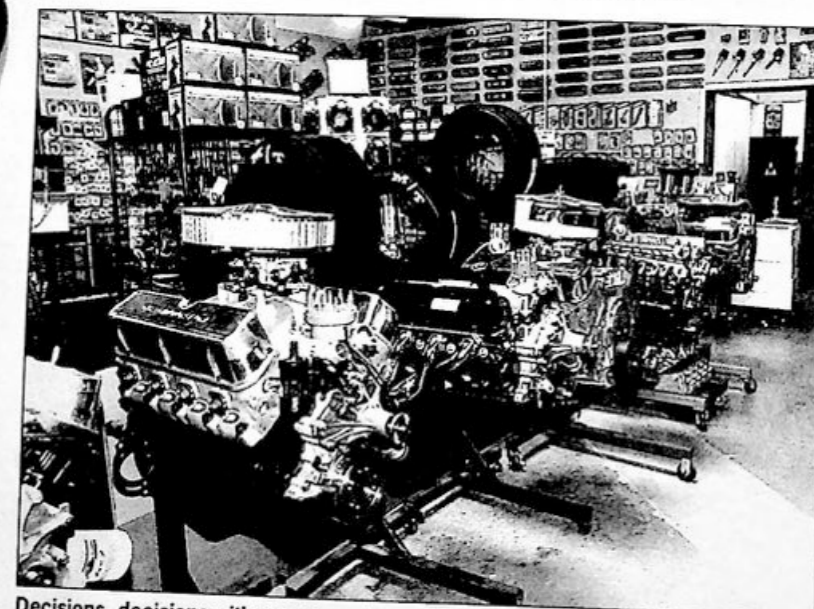
cans agree that a small-block in a big-block body style hurts the resale value (about as much as putting a Bow-Tie block in a Blue Oval replica). Sure, you'll save a few thousand on your initial buildup cost, but when it comes time to sell your completed project a few years later, you may take a hit of as much as \$7000 to \$10,000. (Of course, if the replica itself has a questionable reputation, it won't make much difference how good a motor you drop in there.) If excessive weight is a concern, aluminum components such as intakes, cylinder heads, and water pumps are commonly available and can reduce total poundage by more than 100 pounds.

Given that, which big-block should you use? Both ERA and Contemporary recommend the 428 over the 427, not only because the cost is \$2000 to \$3000 less (approximately \$7000 versus \$10,000 fully dressed), but also because it's a more streetable engine, and nobody will be able to tell the difference between the two without yanking them out and checking the casting numbers and main bearings. (The similarities between the two

allowed Shelby to sneak more than a few 428s into his 427 Cobras. With 427 valve covers on a 428, nobody was the wiser, and the price difference made his original Cobras easier to sell. Most of the 427s went into competition Cobras.) According to engine builder Jim MacFarland (302/335-3369), depending on how the engine is built, a 428 will most probably have a much broader torque curve due largely to its longer stroke. Also, the 427 doesn't run as smoothly below 3000 rpm because the cam profile is hotter. As noted in the main text, when driving around town and accelerating off the line, low-rpm torque is tons more fun than high-rpm horsepower. A 427 will give you more horsepower at peak rpm, but how often will you be able to use it? Of course, if you plan to go racing that's a different story, and the 427's cross-bolted main bearings are a plus for high revs. As for side oiler versus center oiler on the 427, the former was the one used on the original Cobra, but experience indicates there's no significant difference in durability.



Externally, the 427 and 428 blocks are virtually identical in these two Contemporary Classic Cobras, but in this case the valve covers correctly identify the 427 side oiler. The 428, however, costs less and is a more streetable engine.



Decisions, decisions—it's easy to get overwhelmed by all the choices available at your local speed shop. Yet aftermarket performance parts can provide big boosts in output, so a small-block V8 may be all you need.

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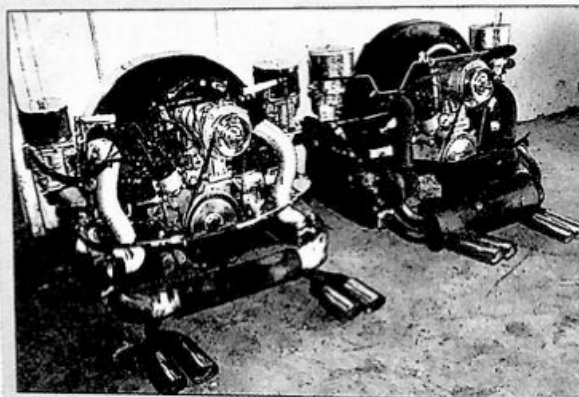
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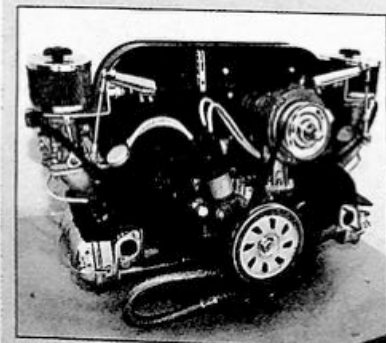
## How to Pick the Right Engine

### THE UNDYING VOLKSWAGEN TYPE I

There was a time when the VW Beetle's powerplant dominated the kit car market, but things are different now (though many people still assume a kit car means VW power). Nevertheless, recently we've seen a resurgence in kits that use the venerable Type I, and for good reasons: It's cheap, lightweight, and bulletproof, and when it does need repair, you can find parts and repair shops anywhere in the world. Auto Classics International (ACI) and Vintage Speedsters (310/402-4334), dual companies that offer replicas of the Porsche 550 and the 356 Speedster, suggest sticking with the stock 70hp, 1600cc engine because the hotter mills run, well, hotter, and they don't live as long either. ACI points out that its 550 is several hundred pounds lighter than the VW Beetle, so the power/weight ratio is considerably better.



cylinder bored out from 85.5 mm to 92 mm will furnish another 20 ponies, which may not sound like much but can make a big difference in a Porsche 550 replica that weighs only 1315 pounds.



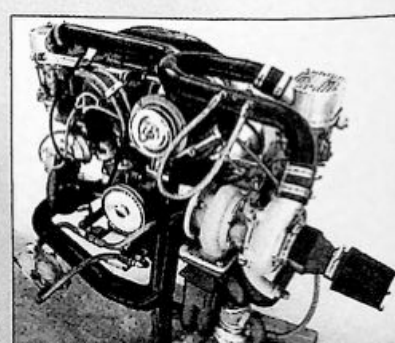
For serious performance, this 160hp, 2110cc runner features 44mm Webers, racing heads and pistons, 90.5mm jugs with an 82mm stroke, and an Engle FK-8 cam with 534 degrees lift and 298 degrees duration. The price is \$3450.

and 1 mph in the quarter-mile. That leads to another point—how much power do you really need? Reliability is something you don't want to give up in a street car for the

Chuck Beck of Beck Development (909/981-3840), who offers similar Porsche replicas, takes a slightly different approach. While he says it's best to use the 1600cc on kits with a VW pan, for his tube-frame Spyder he recommends a 94mm-bore, 120hp version of the VW Type III (station wagon). He offers this modified mill for \$3000.

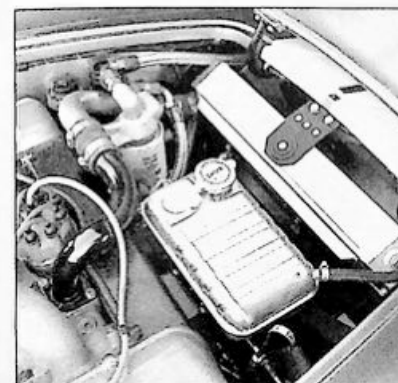
Many of Vintage's and ACI's customers are also willing to pay for more power (note the examples below). If you want to go that route, ACI's Mike Ellis points out that modifying the transaxle's gear ratios is actually more important than the specific power increase, partly because First gear is too short for a light replica, and the engine will rev too high at cruising speed in Fourth. He feels the lower ratio (numerically higher) of 4.37:1 on pre-'68 Bugs is good only for engines between 1600 cc and 1835 cc. Above that, the higher 4.12:1 ratio tranny is better, and the tall 3.88:1 unit is best.

At right is a bone-stock 70hp, 1600cc engine. Vintage says it's the most streetable and durable way to go and offers it for only \$1750. For about \$250 to \$650 more, depending on the carbs, cams, and amount of chrome, the 1835cc unit on the left with the



For powermongers with \$11,000 to spare, this CB Performance turbo mill pumps out 300 hp at 10 pounds of boost. The closed-hat carbs are 45mm Dellortos, and the dry-sump block turns a 73.5mm-stroke crankshaft with Corvette rods.

sake of some arbitrary horsepower numbers. Keep in mind that there's a domino effect as well. If you increase power substantially, you'll also be looking at beefing up the clutch, transmission, driveshaft, rearend, brakes, and cooling system. The latter is especially a concern in the typically smaller kit car compartments where airflow is restricted. Broadly



A remote oil filter mount may be necessary to squeeze a big-block into a constricted compartment.

speaking, street motors run best with about 1.1 hp (or 1.1 lb-ft of torque) per cubic inch of displacement. And with 92-octane pump gas and a street cam, a compression ratio of 9:1 or 9.5:1 is about right, although aluminum heads that run cooler will allow about a 1.0 higher ratio.

Simply because the block fits in the frame doesn't mean it's the right choice. Think carefully about your



A high-rise manifold on a big-block may look really trick, but keeping it cool can be a real problem. This Fiero donor car wouldn't run more than a few miles without the radiator boiling over.

intended use and investment value before committing big dollars to a built engine. Too often we've seen kit car builders get "horsepower happy," only to end up miserable over how poorly the car runs. What we like to see is kit car folks not sweating in their garages over their projects but on the road enjoying them. KC

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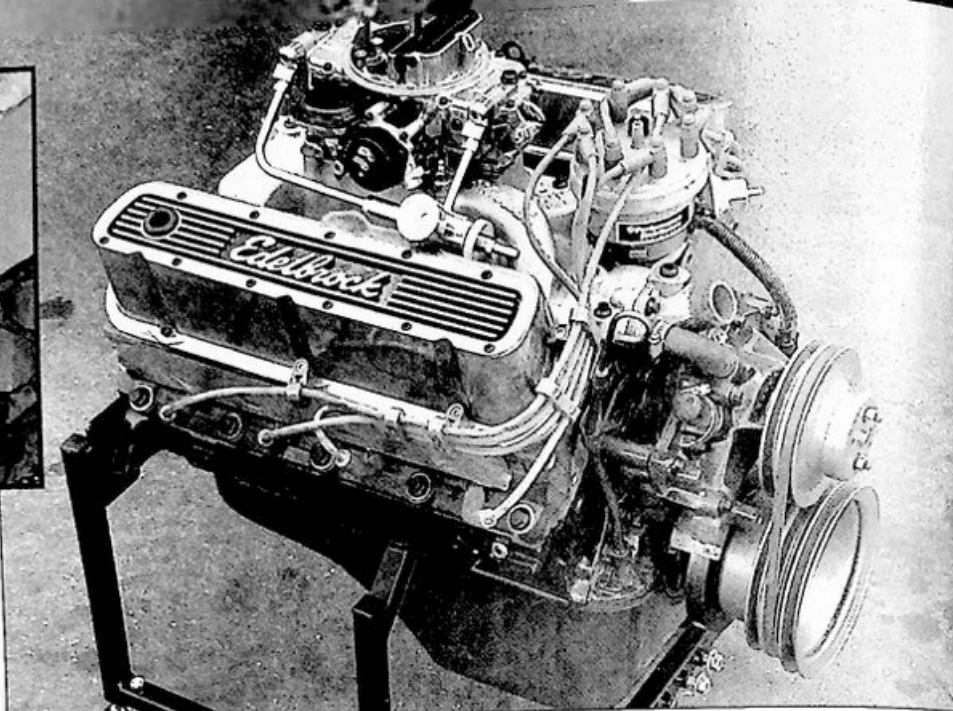
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## ENGINE TECH

Our 289 test mule has been outfitted with Crower Sportsman rods, World Products Windsor Jr. heads, Edelbrock valve covers, an Edelbrock Performer RPM intake, a Performance Distributors electronic distributor, Jacobs Electronics Energy Core wires, Made For You Products spark-plug-wire holders, and a Holley 4010 600cfm 4V carburetor. The small-block Ford shown here delivered in excess of 310 hp and 300 lb-ft of torque on pump gas. The 289 is stored on an Eastwood Heavy-Duty Engine Cradle (PN 1414), which offers a compact design and ease of use.



PHOTOGRAPHY: JIM SMART & ED TAYLOR

# Power Play

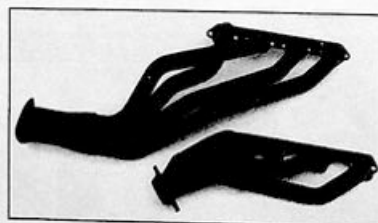
## Big Gains From Low-Buck Bolt-Ons for a Small-Block V8

By Jim Smart & Ed Taylor

One of the great things about our lightweight kit cars is that even a small increase in engine output is immediately noticeable. That means only a modest investment in bolt-on parts can produce a prodigious gain in performance. A kit builder might try any number of engine tweaks on the carburetor jets, ignition system, valve timing, cam sizing, exhaust system, or whatever. But experience says the most direct and effective way to pull more power out of your kit car engine is with a new set of heads. No other single change can make as dramatic a difference as improved airflow. To demonstrate this truism, we started with a plain-vanilla '67 289 Ford and

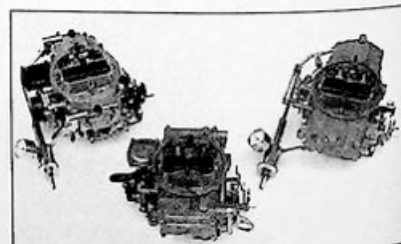
proceeded to pile on an assortment of toppings. Performance Automotive Warehouse (PAW) had already contributed a number of components to the rebuild of this tired old block, to which we also added Crower Sportsman rods and a new Ford harmonic balancer. Tolerances were checked, and the bottom end was balanced as well.

For our first trip to famed engine



You would be amazed at the difference a set of headers makes. J. Bittle Performance supplied a set of shorty headers and a set of long-tube headers for our dyno pull. Long-tube headers offer a substantial increase in torque and horsepower. Shorty headers provide ease of installation and stock dimensions but less power.

builder Kenny Duttweiler's dynamometer, we bolted on the stock Ford 289-2V heads that had been reconditioned by PAW. They had been fitted with larger 1.94/1.50-inch Chevrolet valves and hardened, exhaust valve seats. Edelbrock provided us with a Performer RPM intake manifold (PN 7121) and Elite valve covers (PN 4260). Holley supplied three carburetors for our test: two 600cfm 4V carbs and one 650cfm unit for comparison. J. Bittle Performance sent us two sets of headers—shorties and long tubes—to help us show the power differences and advantages of each type. Shorty



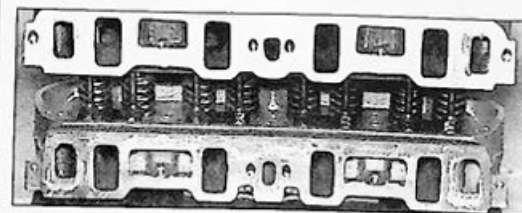
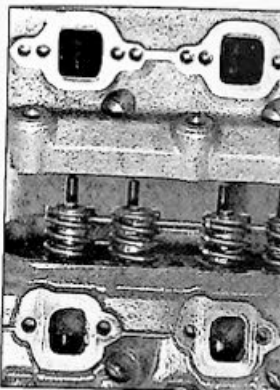
Holley supplied us with three carburetors. From the left: the 600cfm 4010 two-piece carburetor, which offers an appearance similar to a stock Autolite 4100; the 600cfm 1850; and the 650cfm double-pumper. When it comes to torque, the 650cfm carb delivers the most.

headers were born of the need to keep the catalytic converters close to the engine on 5.0-liter Mustangs, but there is some sacrifice in midrange torque compared to long-tube headers. (In some kit car engine compartments, shorty headers are the only ones that will fit, but if you have room for the long-tube units you'll be

happier using them instead.) And finally, Performance Distributors outfitted our Jacobs Electronics-equipped ignition system.

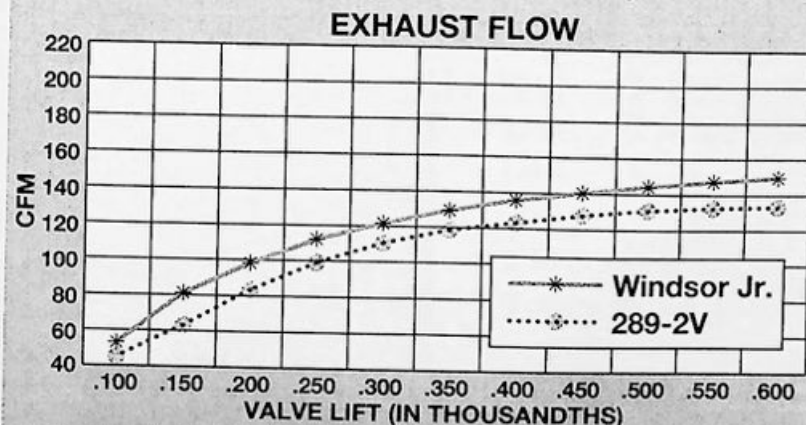
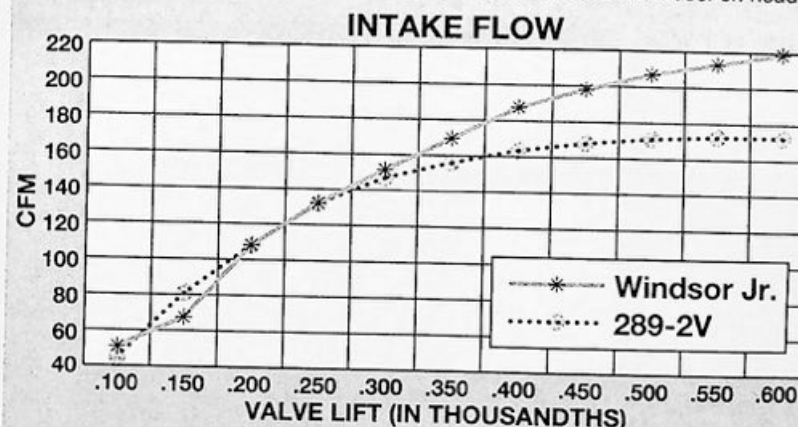
Look carefully at the accompanying graphs to see what various mods do to the horsepower and torque curves. It's really amazing just how much improved airflow both in and

When it comes to cylinder-head bench racing, all bets are off when we visit the flow bench and the dyno. Stock Ford heads offer limited flow on either side of the spark plugs. Visual differences between these cylinder heads are not obvious, but check out the flow-bench results (below). World Products Windsor Jr. heads yielded 219/149.7 cfm at maximum valve lift. We never did determine the limits of these heads. What's more, they gave us 39 bolt-on horses and 8.8 lb-ft of torque!



## Airflow—The Difference Is Clear...

• 289-2V heads with 1.94/1.50-inch valves • World Products Windsor Jr. heads



(Both heads flowed at 28 inches of H<sub>2</sub>O.)

As you can see, there are limits to what the stock Ford head will flow, realized at .550 thousandths of valve lift. We never reached the airflow limits of the Windsor Jr. head.

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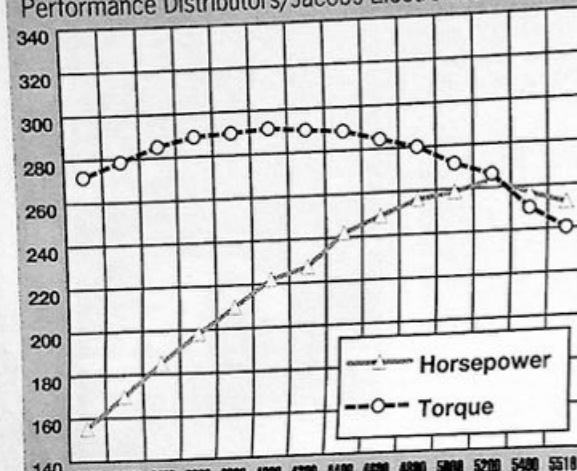
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# Power Play

## Pull No. 1

**Specifics:**  
289-2V PAW heads, 1.94/1.50-inch valves  
Edelbrock Performer RPM (PN 7121)  
Holley 1850 600cfm 4V  
J. Bittle Performance shorty headers  
Performance Distributors/Jacobs Electronics



# Hot Hop-Ups

## Great Bolt-On Parts and Other Goodies for Your Kit Project

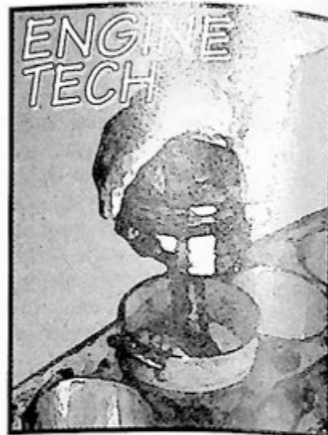
By Jim Youngs

**O**K, the endless hours of block sanding are over. You've made the last trip to the hardware store for stainless lock washers, the alignment is correct, the timing has been adjusted, and you've managed to get the beast licensed. You have been to a couple of shows, talked to hordes of admirers, and hit the cruise night a couple of times at the local Dairy Queen. Pride is burst-

ing forth as the pallet of parts has gone from kit car to road machine. Now what?

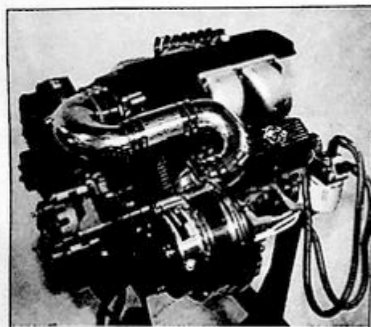
Well, judging by the results of our recent reader survey (see Up Front, p. 4), it's no surprise really that you want to beef up the power. Maybe you got embarrassed a couple of times at stoplights. Maybe the new, lightened version of your donor car doesn't have the beans you anticipated. Or perhaps you just spent most of your original budget on paint but now have saved enough money for some mondo torque and horsepower.

Regardless, none of us ever seems content with the stock output, but fortunately, there is plenty we can do to make some gains. To help with the quest for increased performance, we're bringing you some hot hop-up parts, engine kits, and buildup supplies that should help. So get busy—they're waiting for you at the stoplight.



claims that its system will not burn, rust, or peel off, and that it reduces exhaust heat enough for high-temp paint to be applied over the coating. Applying the coatings requires sending the parts to Swain Tech's facility. Swain Technology, Dept. KC11, 35 Main St., Scottsville, NY 14546, 716/889-2786.

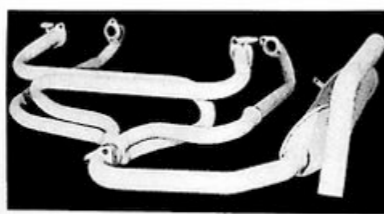
Paxton centrifugal supercharger, a Crane hydraulic roller cam, and American's Stage II porting on AFR aluminum cylinder heads. It develops a 7.5:1 compression ratio with forged Wiseco pistons. To peruse the offerings from mild to wild, send \$2 to American Speed, Dept. KC11, 3006 23rd Ave., Moline, IL 61265, 309/764-3601.



### Et Tu Brutus?

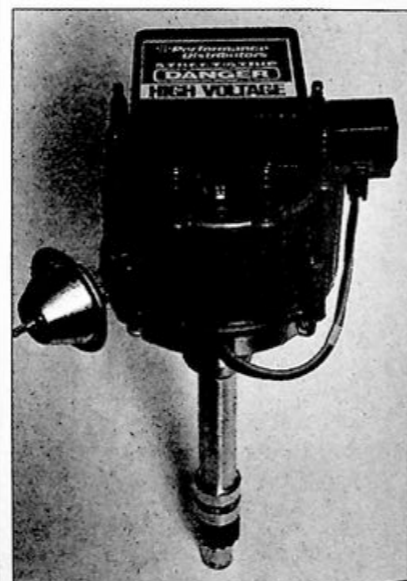
If you don't have the time or inclination to build a hot motor yourself, or you just want to repower your car without the headaches of shagging parts and figuring out the endless details, perhaps a turnkey engine from American Speed is what you need. American offers 30 models of Chevy performance motors, including the stump-puller small-block shown here called the Brutus 434. All of the 300-600hp engines built by American are loaded with name-brand components and are completely blueprinted, balanced, individually machined, and assembled with care. Then they are put on the dyno for breaking-in to assure proper power levels and reliability. This 434 is the newest addition to American Speed's stable and is claimed to develop 600 hp and 565 lb-ft of torque. The engine comes either in a carbureted version or fuel-injected as you see here and is designed to perform with 93-octane gas. Based on a GM Rocket block, the Brutus 434's components include a

42 KIT CAR



### Bug Coating

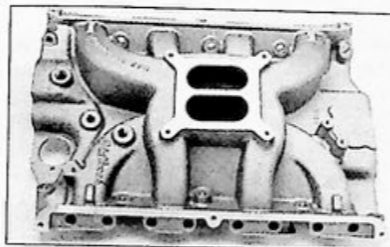
Small engine compartments, air-cooled engines, and headers can work against each other instead of improving performance. Premature heat dissipation from the headers can reduce their scavenging effect. Swain Tech has a Thermal Barrier Coating for exhaust systems that holds the engine heat inside the exhaust system until it gets to the end of the pipe, rather than allowing it to dissipate through the pipe walls. This improves horsepower without overburdening the engine cooling system. Swain's thermal barrier coating is a three-layer permanent system that's .015-inch thick. The base coat is nickel oxide, the second coat is a ceramic thermal barrier coat, and the finish coat is a white, low-emissivity aluminum alloy. Swain



### We Have Ignition

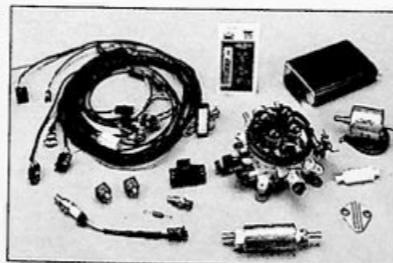
Performance Distributors offers a Street/Strip HEI distributor, complete with cap and coil, that is claimed to increase output by as much as 40 hp and 61 lb-ft of torque over stock units. Its 50,000-volt coil and Dyna-Module allow the unit to fire up to 7000 rpm. Each distributor

is individually calibrated on a distributor machine based on your particular engine's specifications. The advance timing is precisely set throughout the whole rpm range as well. The PD HEI is a drop-in package with brass terminal cap and rotor and blueprinted internals. Each unit is polished to complement the engine compartment. The benefits of a high-performance ignition system are better throttle response, smoother advance curve, and better combustion. Performance Distributors, Dept. KC11, 2699 Barris Dr., Memphis, TN 38132, 901/396-5782.



### Talking Heads

Attention big-block Cobra fans—new from Edelbrock is the Performer RPM FE for 390/427/428 Fords with low- and medium-riser heads. This dual-plane manifold is said to have a broad operating range for streetable performance and high-end horsepower, with a 180-degree design for great throttle response and power in the 1500-6500rpm range. Edelbrock's dyno testing on a 427 medium-riser engine indicated the Performer RPM FE (PN 7105) produced 501 hp. Compared to the Ford Sidewinder manifold, the dyno chart showed 18 hp more at 6000 rpm and 24 lb-ft more torque at 3500 rpm. Edelbrock Corp., Dept. KC11, 2700 California St., Torrance, CA 90503, 310/782-2900.



### High-Tech Holley

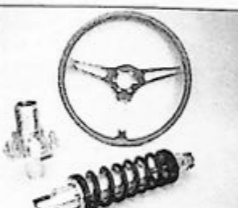
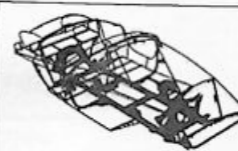
Holley has introduced six new digital fuel-injection system retrofit kits for carbureted, noncomputerized engines. The benefits of precise, calibrated fuel delivery are now available as a direct replacement for a carburetor. The Pro-Jection 4Di (digital interactive) and 4D (digital) throttle-body systems are available in 650-, 700-, and 900cfm models and

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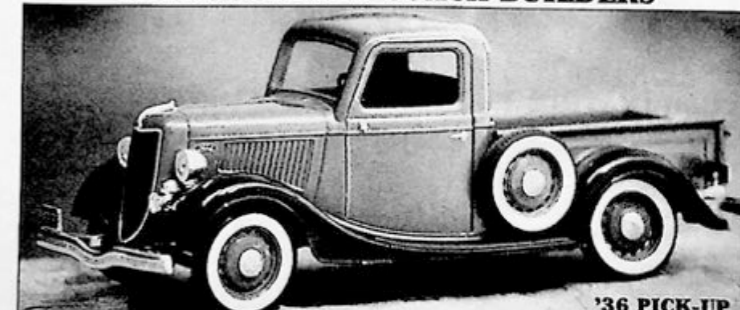
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will accommodate 150-500hp ranges. They are true speed-density, micro-processor-based, closed-loop systems. The 4Di system allows users to infinitely control fuel maps and ignition curves using an IBM-compatible personal computer. Five fuel maps and an ignition map are included on a PC disk as starting control points. They sense engine parameters such

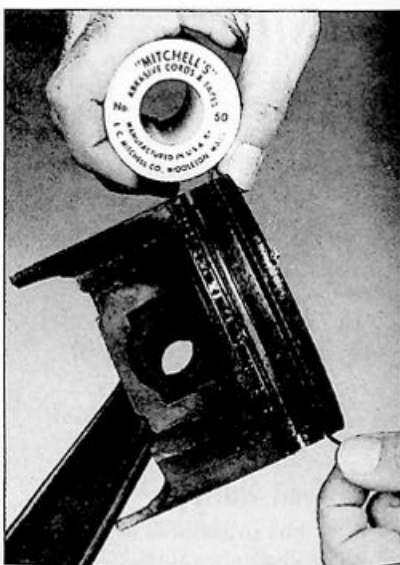
as air charge temperature, engine coolant temperature, throttle position, exhaust oxygen, engine rpm, and manifold pressure. Holley's 4D system allows the user control of a base fuel map through a handheld calibration module. It also has PC interface capabilities that let the user read the fuel map and monitor the operating conditions of the engine. Both systems provide various fuel/air settings for idle fuel, idle stability, main jetting, secondary jetting, accelerator pump, and rev limit. Each system includes a throttle body,

in-line fuel pump, wiring harness, sensors, digital electronic control unit, and all other components necessary for installation. Holley Tech Service, Dept. KC11, P.O. Box 10360, Bowling Green, KY 42102-7360, 800/HOLLEY-1.



### Expansion Team

Some of the kit cars we build have impossibly tricky radiator access, so expansion tanks like Moroso's new aluminum billet-neck models could be handy items. Made of welded aluminum with 6061-T6 billet aluminum filler necks, these expansion tanks provide a convenient fill location and bleed-off point for unwanted air in the coolant system. The tanks are pressure-tested and include welded-in pipe fittings to plumb overflow and filler lines. Moroso uses a tough billet neck on these tanks to better withstand the constant abuse of removing and installing radiator caps. They are available in two sizes up to 1.5-quart capacity, and both measure only 6½ inches high by 7 inches wide. Moroso Performance Products, Inc., Dept. KC11, P.O. Box 1470, Guilford, CT 06437, 203/453-6571.



### Engine Floss

Just like with your teeth, gunk can build up in little slots, crevices, holes, and grooves in your engine unless you floss. We can think of many uses for Mitchell's Abrasive Cords, especially when it comes to

cleaning baked-on carbon, fuel deposits, or corrosion from otherwise inaccessible areas. It may even be possible to use this engine floss for sanding tight body components, suspensions, and exterior engine parts without having to take them apart. These abrasive cords are impregnated with aluminum oxide or silicon carbide and are available in 12 sizes from 0.012- to 0.015-inch diameters. The cords are flexible and easy to cut using heavy-duty shears and are packaged in 50ft lengths wound on spools. Mitchell also offers handy flat tapes, ¼- to ½-inch wide, with abrasive on both sides. Mitchell's Abrasive Cords and Tapes carry a list price starting at \$12.50 per spool. E. C. Mitchell Co., Inc., Dept. KC11, 88-90 Boston Rd., Middleton, MA 01949, 508/774-1191.



### Internal Medicine

Building a cookin' engine requires not only quality bolt-on parts but also the right sealants to ensure good operation and dependability. Fel-Pro has developed a new line of color-coded, engine-sealing chemicals that not only make it easy to distinguish the proper product for each task but also serve about 95 percent of all engine-sealing applications. The four new sealing products include Gray Bolt Prep, Red RTV Silicone, Blue Gasket Sealer, and Yellow Gasket Adhesive. The bolt prep serves as a graphite-based thread lubricant, thread locker, sealant, and anti-seize compound. The RTV silicone is a high-temperature, oxygen-sensor-safe adhesive/sealant. The gasket sealer is said to be an extra tacky product for keeping metal or fiber gaskets in place and sealed during assembly. The gasket adhesive is a quick-installation, contact adhesive aimed at holding cork or rubber gaskets in place during engine assembly. An application chart comes with each product. Fel-Pro Inc., Dept. KC11, P.O. Box 1103, 7450 N. McCormick Blvd., Skokie, IL 60076-8103, or contact your local parts retailer.

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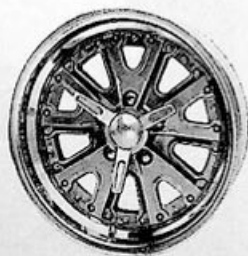
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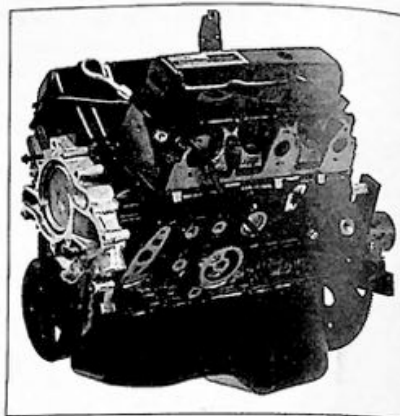
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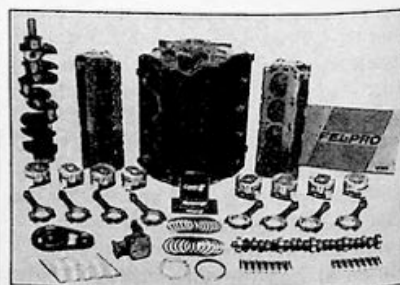
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coolant flow with an efficient impeller design and housing that will better feed each side of the engine and keep things cool. Weiland offers models for Chevy small-blocks and big-blocks, early Chrysler hemis, and Ford motors from 302 through 460. Weiland Automotive, Dept. KC11, P.O. Box 65301, Los Angeles, CA 90065, 213/225-4138.



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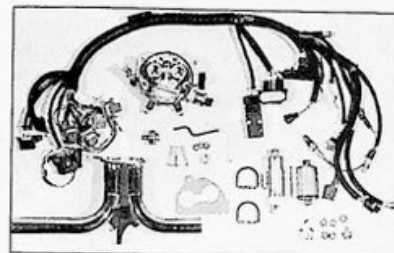
If a V8 just won't fit in your kit, then how about a potent V6 crate motor? Mail Order Autocenter has just introduced a 140hp, 2.8-liter GM V6 with 160 lb-ft of torque all wrapped by a 12-month parts warranty. The 2.8-liter H.O. is offered as a carbureted version with throttle-body and tuned-port EFI available on a custom-order basis. The engine includes a high-performance cam which is said to produce good midrange torque and horsepower. It is also fitted with hi-po cast-iron heads (1.72-inch intake valves, 1.42-inch exhaust valves), a flywheel, front cover, harmonic balancer, oil pan, and oil pump. This 60-degree V6 can be an even hotter mill with an abundance of hop-up goodies available from several aftermarket sources. Autocenter, Inc., Dept. KC11, 9001 Sovereign Row, Dallas, TX 75247, 214/634-3900.



### PAW Power

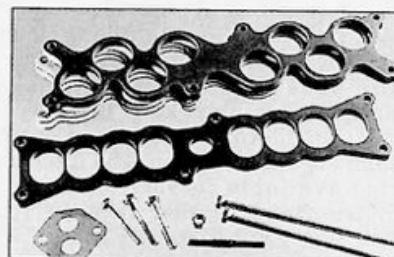
Performance Automotive Warehouse says its Ford 351 Windsor Special Engine Kit offers kit car builders the best of all worlds—top-quality,

brand-name parts, precision machine work, and the ability to custom-design a package specifically for your application. Standard kits offer compression ratios ranging from 8:1 to 10:1 (with options available for other ratios), along with bigger valves, aftermarket cylinder heads, and more. A full-time tech line offers professional assistance to the first-time builder as well as the experienced mechanic. Kits are available in a variety of stages with long-block prices starting at \$1695. PAW, Dept. KC11, 8966 Mason Ave., Chatsworth, CA 91311, 818/998-6000.



### VW Fuel Injection

Tired of hassling with the sticking floats and flooding carbs on your Bug-powered kit car? Turbo City has a new VW fuel-injection system designed for any 1600-2800cc VW engine from 85 to 200 hp. The kit includes a throttle body, fuel pump, sensors, manifold, wiring harness, fuel filter, computer, and custom chip. Detailed instructions come with the kit, but Turbo City also offers installation. Turbo City, Dept. KC11, 1137 W. Katella, Orange, CA 92667, 714/639-4933.



### Spaced Out

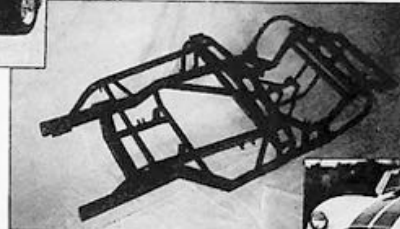
The basic key to keeping performance engines operating at the optimum is proper breathing. Ford 5.0-liter engines now have some help in this area in the form of Mr. Gasket's insulated intake spacers. These spacers are designed to effectively block engine heat from transferring into the upper intake plenum, which is claimed to provide a cooler, denser, and more powerful air charge to the cylinders. The spacers are made from 3/8-inch-thick, laminated phenolic fabric and are not so thick as to cause a clearance problem on stock

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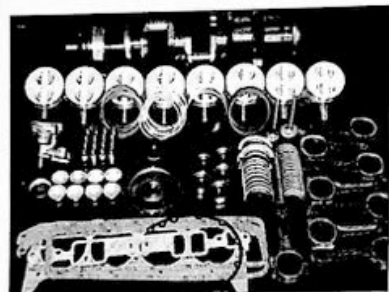
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## Hot Hop-Ups

Mustangs. Mr. Gasket offers thermal intake spacers with or without EGR passages for emissions considerations and units for stock or GT-40 manifolds. Mr. Gasket Performance Group, Consumer Inquiries, Dept. KC11, 8700 Brookpark Rd., Cleveland, OH 44129, 216/398-8300.



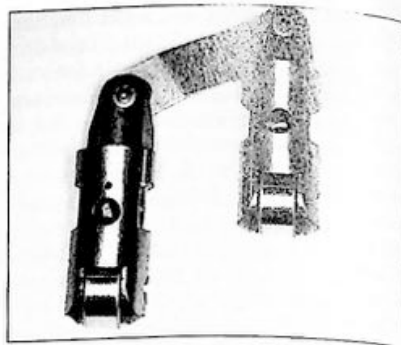
### Blue Streak Engines

Blue Streak Engines offers wholesale prices for high-perf and stock engine kits. Available is a full line of engine kits—not just small-block Chevys. Blue Streak also offers custom kits to meet special needs, as well as complete machine shop services. It sells the kits outright or on an exchange basis. Blue Streak Engines, Dept. KC11, 1125 S.W. 29th, Oklahoma City, OK 73109, 405/634-8133.



### Jacobs Ultra Team

The Jacobs Ultra Team is a complete ignition system that includes the Energy Pak computer, Energy Core plug wires, and the Ultra Coil. The Energy Pak is the brain of the system, as it adjusts spark output cylinder-by-cylinder according to engine need, which also produces smoother running at low or high rpm. The Energy Core wires have a spiral metal core, with less than 200 ohms of resistance per foot. The silicon-Teflon-coated wires are 100-percent waterproof. The advanced high-performance Ultra Coil puts out a big spark and runs cool, even in racing conditions. The Ultra Coil is also available separately. Jacobs Electronics, Dept. KC11, 500 N. Baird St., Midland, TX 79701, 800/627-8800.



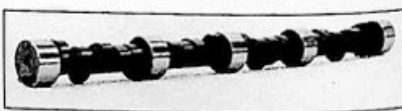
### Crane Roller Lifters

Crane roller lifters are the latest in valvetrain technology for street-performance applications. The reduction of friction plus the increased torque and horsepower of a roller cam profile is the best possible combo for the street. Other benefits include a broad power band and increased rpm potential with low maintenance. A variety of Chevrolet and Ford applications are available, including a Ford retrofit setup for pre-roller-lifter small-block engines. Crane Cams, Dept. KC11, 530 Fentress Blvd., Daytona Beach, FL 32114, 904/252-6174.



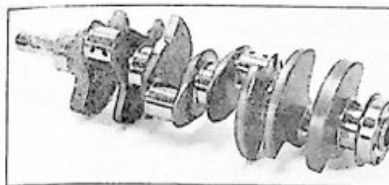
### Dry-Sump Oil Filter

System One Filtration has released a new-design inline Scavenge oil filter for all dry-sump systems. It features high-flow, -16 AN fittings on the inlet and outlet ends. Measuring 2 1/4 inches in diameter, its 10-inch length allows it to fit under the hood of most vehicles. The housing has System One's cleanable stainless-steel filter element for lifetime service and optimum engine protection. The filter is also available in smaller sizes. System One Filtration, Dept. KC11, P.O. Box 1097, Tulare, CA 93274, 209/687-1955.



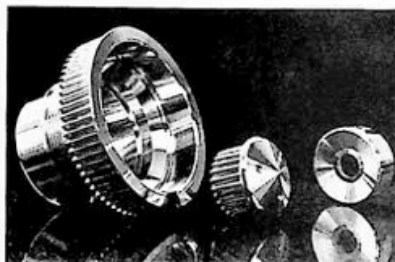
### Reed Cams

Reed Cams carries a complete line of solid-lifter flat-tappet cams. It also makes custom grinds. Solid lifter grinds are available in standard and tight-lash setups. Reed also has valvetrain components, carbs, and single-piece pushrods. Reed Cams, Dept. KC11, 2036 Chamblee Tucker Rd., Chamblee, GA 30341, 404/451-5086.



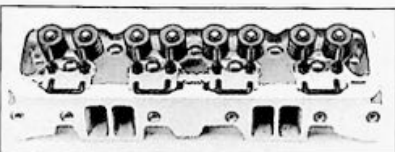
### Ford SVO Small-Block Cranks

Three new crankshafts feature either Moldex or Bryant oiling systems for 302 and 351 SVO engines. Other features include precision-ground rod and main journals, large-fillet radii, knife-edged counterweights, and pin-lightening holes. The cranks are available in three different stroke applications. Ford Motorsport SVO, Dept. KC11, 44050 N. Groesbeck Hwy., Clinton Township, MI 48036, 313/337-1356, or contact your local Ford Motorsport retailer.



### March Blower Cog Drive

The March cog system drive prevents lost boost associated with conventional blower drive systems. It's equipped with a special guide ring on the drive and blower pulleys. The design prevents belt walk-off, which is common in high-torque situations. A full range of ratios is available, and the pulleys are CNC-machined from aircraft-grade billet aluminum, then clear-powdercoated. March Performance Pulleys, Dept. KC11, 5820 Hix Rd., Westland, MI 48185, 313/729-9070.



### LT1 Cylinder Heads

Air Flow Research announces the addition of reverse-cooled LT1 heads, which are 50-state legal per CARB E.O. No. D-250-3. They are a direct replacement for '92 and newer LT1 engines. Optimum flow characteristics and increased structural integrity make these heads a significant upgrade over stock. Air Flow Research, Dept. KC11, 10490 Ilex Ave., Pacoima, CA 91331, 818/890-0616. **KC**

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# Q&A

By Jim Youngs  
RAMPORSCH

I am in the market for a '74 or later Porsche 914. I plan to install a V8 and a body kit. All the ads I've seen in your magazine are for Chevys. I have a '77 Ramcharger 4x4 that is rotting away. It has a two-barrel, 360ci engine that has covered only 40,000 miles since it was redone. According to *Motors Truck Repair Manual*, it cranks out 170 hp at 4000 rpm and 280 lb-ft of torque at 2400 rpm. My questions are the following:

Can I install this engine in a 914? Who makes an installation kit for this application? How much power and torque can the transaxle handle? What modifications can I do to the engine or transaxle to accommodate more power, say 325 hp? Since this will be a street vehicle, should I concentrate on horsepower or torque?

John Mejia  
Tampa, FL

Andy Leaney of Renegade Hybrids (909/307-2150) specializes in Porsche transaxles and V8 conversions to Porsche transaxles. He says he could handle a Mopar conversion but favors Bow-Tie blocks. As an example of what's possible, Renegade offers a rebuilt 914 transaxle to handle up to about 300 hp, and a 915 transaxle with a flipped ring gear that will handle up to 500 hp. The company also has engine adapter plates, flywheels, and clutches among other conversion items. You're right, Ford and Chevy get the bulk of the attention, but there is a host of performance goodies available for your engine. You just have to look a little harder. You might start with a good set of headers and then follow with an Edelbrock (310/782-2900) Performer Plus cam and intake combination. While the engine is

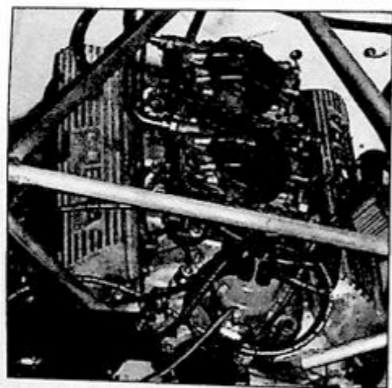
apart you might also want to consider some porting work, larger valves, and pistons. Weiland (213/225-1346) is also a good source for Chrysler manifold designs, and Mopar Performance (810/853-7290) is a good number to have on hand. HP Books' (800/631-8571) *How To Hot Rod Small-Block Mopar Engines* should also be a valuable reference. Regarding horsepower and torque, we've found a Chevy small-block overwhelms the 914's clutch in first gear, so we'd recommend going easy on the amount of torque if you don't change the gear ratios.

## BLUE OVAL Z-CAR

Hey, you guys have talked about V8s in Z-cars, but it seems it involves a Chevy motor every time. How about us Ford fans? I have a 5.0 Mustang V8 just sitting here, and I would love to put it into my favorite of all cars, a Datsun 280Z. Can it be done?

James Holland  
Albany, NY

Your timing is perfect, James. We just recently received a letter that discusses



just this subject, and we'll let it serve as an answer to your question:

After years of reading your magazine, I feel I can hold back no longer. For all of you Ford enthusiasts out there (don't all raise your hands at once), I've got some firsthand experience with swapping a Ford V8 into the early Z-cars. The swap is fairly straightforward, and when combined with the Ford's lighter weight, front distributor, and small size, it's a swap I've never regretted. Included with the swap data I have some significant brake, driveline, and handling updates using salvaged factory Datsun/Nissan parts. The front brake rotors are 300ZX (bolt-on) with front Maxima rotors on the rear (bolt-on) covered with 280ZX calipers all

the way around (almost both). The T5 manual transmission shift knob comes out in the exact same place as the original shifter, and the driveshaft is all Ford. It has been shortened and then bolted to the Datsun differential. I used factory CV-jointed halfshafts. Also, the 302 V8 with Motorsport J302 heads is 40 pounds lighter than the original Z engine. I used an aluminum radiator, and with the placement of the engine I achieved a 50/50 weight distribution. I used 200-pound rate springs at all four corners with custom sway bars from a GM truck. The fiberglass body is a one-off design I made in the driveway. The whole car weighs 2200 pounds, and the high-performance mods were low-cost. If any Kit Car readers out there care to try this, I'll be glad to assist. I can be reached at 501/224-6452.

Terry Oxendale  
Little Rock, AR

## FORWARD TO THE REAR

Several of the kits I'm considering are designed for a mid- or rear-engine layout. Here's my question: Would it be feasible to use a complete engine/transaxle unit from one of the many front-wheel-drive production cars in a rear-drive configuration? The way I see it, the engine is already mounted transversely, and if the steering rack were replaced with a fixed steel bar, you'd have a compact and complete drivetrain setup based entirely on commonly obtainable parts and an independent rear suspension to boot. Would this work?

Paul Witek  
San Francisco, CA

Using a front-drive system to drive from the rear has distinct possibilities. Actually, the Fiero's midmounted Iron Duke drivetrain started life in GM's front-drive X-cars ('80-'85 Citation, Pontiac Phoenix, and so on). The vestigial steering tie rod attachments serve as rear toe-in adjustments. Similarly, the Ferret (March '92) used an '80 Citation four-wheel-drive unit transplanted to the rear. Whatever engine/transaxle you have in mind, some fabrication would be necessary for suspension attachment points, shifter linkage, and the like, but it seems possible. We also have heard about using an Oldsmobile Toronado setup as a rear pusher. You may also want to consider the Fiero transaxle setup as is, which should be fairly easy to adapt to a mid-engine arrangement without any steering problems. **KC**

Have some questions about your kit car's drivetrain? Send them to *Kit Car Engine Tech* Q&A, 6420 Wilshire Blvd., Los Angeles, CA 90048-5515.

# KIT CAR

## THE SPECIALTY CAR MAGAZINE

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Cobra Restorers, the replica builder's part source, introduces its new two-color catalog #7, with 40 percent more pictures and 30 percent more parts. It includes its all-new "Valu-line" replica parts for the thrifty builder who demands high quality without the high price. \$5 (refundable with order).

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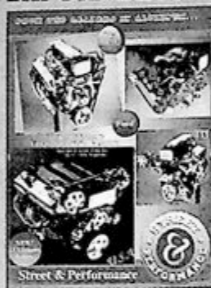
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Corvette Central's 20 years of experience in manufacturing and distributing Corvette parts has led it to create the Corvette Parts Master catalog covering '53-'82 models. Its latest addition is the Concept 57 Corvette, a complete reproduction body and an upgraded '57 chassis. Both are available in kit form along with all the associated parts found in the catalog. \$4.

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A&M SoffSeal's catalog covers weatherstripping and rubber detail parts for GM and Chrysler products. Specifically, '55 and later GM cars, '40's and up GM trucks and '62-'74 Chrysler Performance A, B & E bodies. Products are made with the highest quality sun and ozone resistant materials. Also, new is a line of weatherstripping designed for street rods and customs. \$3.

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Performance Automotive Warehouse is one of the nation's leading mail-order suppliers for the automotive enthusiast. The company's new 530+ page catalog contains engine parts, kits, and accessories for all makes/models of domestic cars/trucks. Performance, racing, or stock parts available. \$5.

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The 1996 Ford Motorsport SVO Performance Equipment catalog features 128 pages of the latest high-performance parts and accessories for the Ford enthusiast, including new 5.0L Supercharger Kits and additional new parts for '95 Mustangs and F-Series trucks. Also included are engine, chassis, and driveline components plus complete dealer listings, how-to technical information, and hard-core parts and accessories. \$5.

## 21 SPEEDWAY MOTORS

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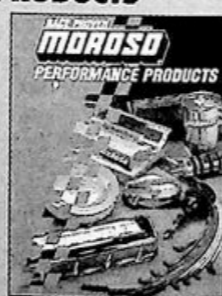
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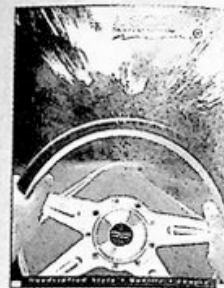
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By Harold Pace

Some 38 years ago in Hornsey, England, a brilliant young engineer named Colin Chapman unveiled his latest sports car, the Lotus Seven. It didn't look like much, just an aluminum cigar with cycle fenders, but boy did it go! With less than 1000 pounds to haul around, tiny Ford and Coventry-Climax engines took the Lotus screaming past more muscular sportsters on the airfield circuits that sprang up in England following WWII.

Chapman's Mark 11 race cars were winning everywhere. The Seven's space frame was loosely based on this sleek sports racer, with front suspension borrowed from the Mark 12 Formula 2 car. Born in a desperate attempt to raise much-needed cash, the Seven was a simple, inexpensive sports car for street use and amateur-level racing events. Due to an English tax system that gave a substantial break to kit cars, it was not sold fully assembled. In fact, English regulations in the '50s prohibited including assembly instruc-

tions. The owner's manual remedied this omission by giving comprehensive instructions for a rebuild following an accident. (And, see whiz, they showed a complete reassembly, too.)

These Series I cars were offered in several forms, and specifications ranged from an anemic, side-valve Ford four-cylinder engine with a three-speed transmission and drum brakes to the sizzling Super Seven sporting a Coventry-Climax SOHC mill pumping out a then-respectable 75 hp. A four-speed gearbox was used, and some racing models used a

de Dion rear suspension system and disc brakes. Engine upgrades and chassis refinements followed. Meanwhile, Lotus Formula 1 cars captured two World Championships, and a Lotus Indy car won the Indianapolis 500 with legendary driver Jimmy Clark.

In 1968 a party took place outside a pub in the tiny English village of Ringlestone. A mob of well-wishers greeted the guest of honor, the new Series III Lotus Seven, and orders were taken as the test drives began. Many of the improvements incorporated into the new model had been suggested by Graham Nearn, who was the sole distributor for the Seven in England. Remember his name.

Aside from many changes to enhance reliability, the biggest news was the Ford 1600cc engine, which had enormous potential for modification and sported a crossflow cylinder head. Also offered was the famed Lotus Twincam that belted out 125 hp. Meanwhile, Lotus chalked up another F-1 World Championship in 1968 with mustachioed Londoner Graham Hill.

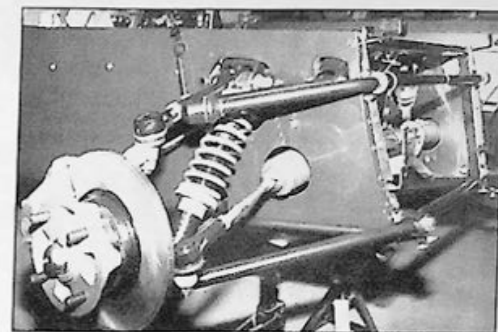
### A Knight to Remember

Unlike the fete in 1968, a year later there were several unhappy faces at the unveiling of the radically changed Series IV. The wedge-shaped lines and more comfy interior did not sit well with those shut out of the redesign—including Chapman himself, who had been occupied with other projects during its gestation

period. It wasn't a bad car, what with the Lotus Twincam mill, but perhaps it tried to please too many people. It sold fairly well but below (perhaps unrealistic) expectations. It also proved to be more costly and difficult to maintain. By 1973 Lotus was busy with other projects, having won yet another F-1 championship in 1972 with Emerson Fittipaldi. It wanted to get rid of the "kit car" label, and only a knight in shining armor could save the Seven. Fortunately, one was available.

Astute readers will have guessed that the aforementioned Graham Nearn was the Seven savior. When Lotus axed the Seven, Nearn's company, Caterham Cars, took over the manufacturing in 1974. After attempting to restart Series IV production, Nearn returned to the simple Series III model when it proved to be more practical to build—and more popular as well. The Lotus Twincam powered many of these featherweight road rockets, although the cheaper 1600 crossflow was also offered. Later, Cosworth and Vauxhall four-valve engines of up to 250 hp flung Sevens down many a winding country lane.

Numerous suspension mods were developed, including an improved wishbone design for the front suspension and the reintroduction of a de Dion rear suspension. These changes resulted in a better car, but they brought a significantly higher price as well. Luxury interiors (a relative term), fancy wheels, and high-tech powertrains were changing the



The front suspension is available in two forms, either the original-style Classic or the updated HPC version (shown).

Seven's character. Americans were deprived of much of this in the '70s, as nebulous import regulations barred most Caterhams from U.S. shores.

Due to the simplicity of the Lotus Seven concept, there have always been cars inspired by (i.e. shamelessly copied from) it and offered at lower prices. In response, Caterham introduced a new model in 1994 called the Classic. The model returned to the early Super Seven concept, with the original-design front suspension of the Series II and a Ford live axle at the rear. Ford 1600 crossflow engines are provided for English market versions, and interior appointments are Spartan. This keeps prices low and pleases purists who derided many of the "improvements" of later Caterhams as trendy and soft.

### Enough History Already—What About Now?

To get the lowdown on what's new, let's go across The Pond to the Texas Motor Works in Arlington, near Fort Worth (or Foat Wuth if you're a good ol' boy). Owner Dick Brink sells Caterhams in all suspension and option configurations. In order to pacify Uncle Sam, however, the buyer must provide his own engine and gearbox. Caterhams can be ordered with engine mounts to fit a variety of powertrains, although the most popular is the Ford 1600 crossflow with a four- or five-speed transmission.

These engines are plentiful, as they came in '60s Cortinas as well as many '70s Capris and Pintos. They are also required in Formula Ford (FF) racing, so modified mills are available from race shops across the country. These engines churn out 110 to 115 hp with amazing reliability, using only a single two-barrel Weber carb—although many Seven owners update to dual 40mm sidedraft Webers.

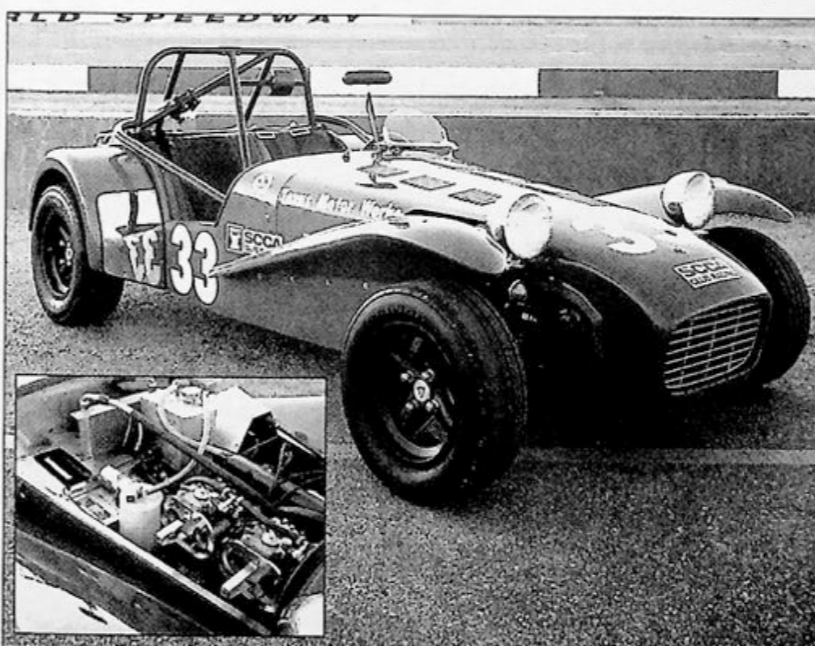
This power is enough to propel a Caterham, which weighs around 1125 pounds, through the quarter-

NOVEMBER 1995 57

# LOTUS VS BLOSSOMS

The Bloom is Still on the Bud for One of the All-Time Kit Car Classics

PHOTO LOCATION CEDAR HILL STATE PARK, CEDAR HILL, TEXAS



Outfitted for competition duty, this Caterham Challenge car at the Texas World Speedway features a Formula Ford powerplant, dual Webers, a dry sump tank, and an oil cooler.

PHOTOGRAPHY: HAROLD PACE & HAROLD L. LYDICK, JR.

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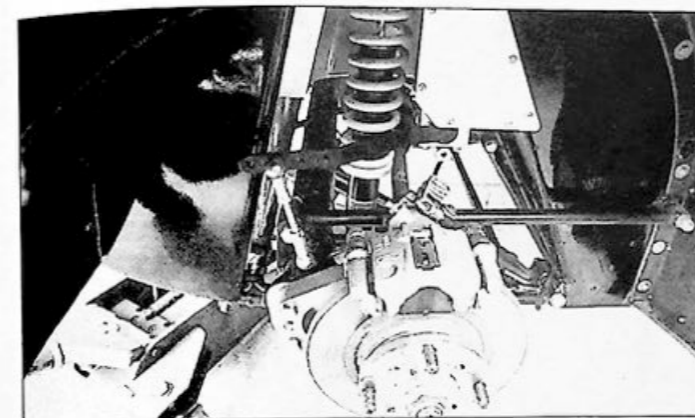
John Wills

# LOTUS BLOSSOMS

mile in about 15 seconds, depending on tires and gearing. There are Seven enthusiasts, however, for whom anything worth doing is worth doing to excess. For them, engine mounts can be supplied to fit Vauxhall, Lotus Twincam, and Cosworth BDA powerhouses. The 2000cc Vauxhall mill shown in the lead photo pumps out 165 horses. Quarter-mile times can drop into the high 12s, at which point a high-performance-driving school should be mandatory (as it is in England,

where school attendance is required before the purchase of the most powerful Caterhams).

Two basic models, the Classic and the HPC, are available. The Classic is offered in street or race trim, and both models use a live rear axle and disc/drum brake configurations. Either cycle-type or flared fenders can be specified. Price for either model is about \$18,000 in component form, minus the engine, gearbox, and tires (prices vary with the fluctuating dollar/pound exchange rate). The

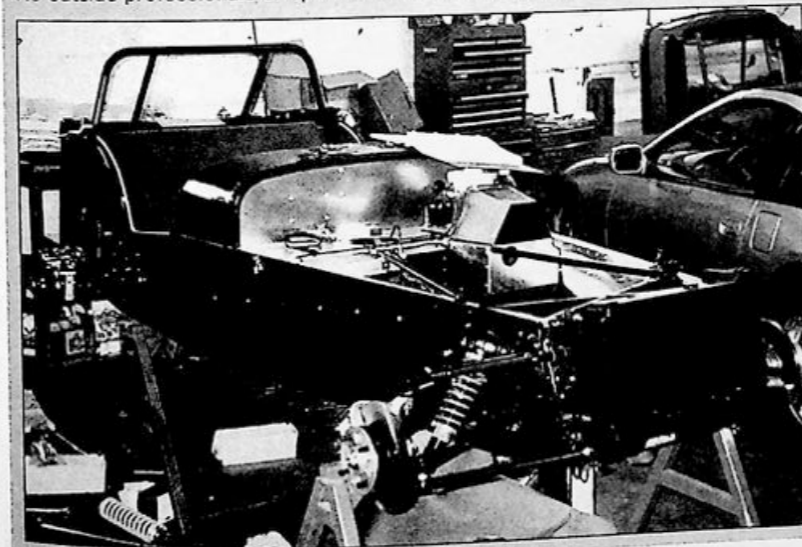


Trailing links locate a de Dion tube. Note the upper sway bar with adjustable link.

## EASY TO BUILD—REALLY, IT IS

Assembling a Caterham is, comparatively speaking, a trip to Nirvana for most kit builders. No welding or fabricating. No doors to hang. No slogging through junkyards for '58 Impala taillights or rear windows. The entire kit arrives in one crate, inside which an astonished buyer will discover a partially assembled chassis with all the gauges installed and wired.

All the parts are there, and, with the aid of an assembly video, the Caterham can be up and running in 50 hours or less. Brink says the first one took him that long, but he now has it down to about 35 hours. (The record, incidentally, is held by a Lotus employee who once assembled a kit in 4 hours for a publicity stunt.) No outside professionals or specialized tools are required.



HPC features the updated front wishbone suspension, four-wheel disc brakes, and a de Dion rear end. All this technical wizardry adds about \$3000 to the price of a Classic.

## How Does It Drive?

In a word, fast. It has more the feel of a Formula Atlantic than a Cobra, for sure. No point-and-squirt histrionics, just the ability to cover a lot of winding road in a very short time. Its low profile and limited ground clearance allow the driver to reach over the door side to retrieve stray pennies. The windshield doesn't do much shielding, so speeds above about 55 mph result in a maelstrom sure to make any motorcyclist wax nostalgic about pre-helmet-law days. This exposure to the elements and these kart-like response times truly make the Caterham an extension of the driver—even in areas where the driver might not like to be extended. But no one buys one of these devices for creature comforts. Think of it as a Grand Prix bike for two. It may be cramped and basic, but point it down a winding, hilly road and go for it.

Lotus and Caterham Sevens have captured checkered flags all over the world. Since Colin Chapman intended for Sevens to be raced, Brink is setting up the Super Seven Challenge Series to promote amateur-level-competition events in conjunction with vintage racing clubs across the country. Some vintage groups will not allow Caterhams to run in true vintage events, so Brink's series may run as a separate group or with the Exhibition class. Any Seven variation built by Lotus or Caterham is eligible for the Super Seven Challenge.

There are plans (still being formulated) for American-series champions to go to England to take on the champs from similar British series. Yanks "carrying coals to Newcastle" for some spirited competition would be a strange turn of affairs, but it probably wouldn't have come as a surprise to Colin Chapman. **KC**

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# MIDSTATES MUSCLE

At the estate auction, the '59 Ford Ranchero didn't look like much. Its wheelwells were rusted out, the seats weren't bolted down, the hood wouldn't open, and the engine wasn't even turned over. George Anderson bought this basket case anyway—for only \$500—figuring he might be getting a halfway decent motor in the deal. Once he pried open the hood, he thought the engine was probably a 352 FE, but why did it have three two-barrels on it? Then he realized he'd struck gold.

He never imagined he would scrounge up a sleeper

## How a 46-Year-Old "Absolute Adolescent" Packed a Wallop Into His Cobra Project

By Steve Temple

with a 427 FE center oiler. Under the banner of Gessford Racing (Anderson owns Gessford Machine Shop), he flogged the old truck at the local drags a few times and managed low 14s in the quarter—not bad for a 5000-pound lead sled with a functioning cop's spotlight and three on the tree.

With purple flames and "Absolute Adolescent" painted on the sides of his Jurassic beast, he was really having fun—until the driveshaft disintegrated into the left-rear Mickey Thompson slick at 100 mph. Wife Josie laid down the law: This was the first and last time she'd tow her



PHOTOGRAPHY: STEVE TEMPLE & GEORGE C. ANDERSON

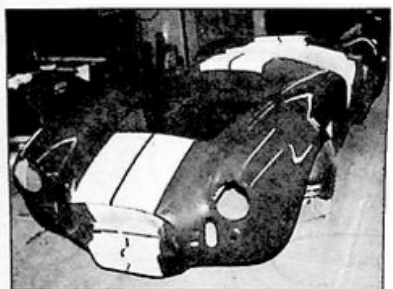


# MIDSTATES MUSCLE

husband and his junk trunk back to the pits.

A dutiful husband, Anderson came up with a suitable compromise: He would build a Cobra instead. Actually, it was Josie who suggested driving 3 hours to Hooper, Nebraska, to tour the factory of MidStates Classic Cars. Anderson knew he was on the right track when she said red with white stripes would look really cool, and he assured her that most of the engine parts from the old Ranchero could be used on the Cobra.

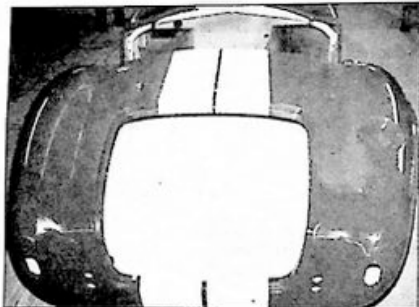
Over the years, MidStates' Bob Kallio has developed a reputation for



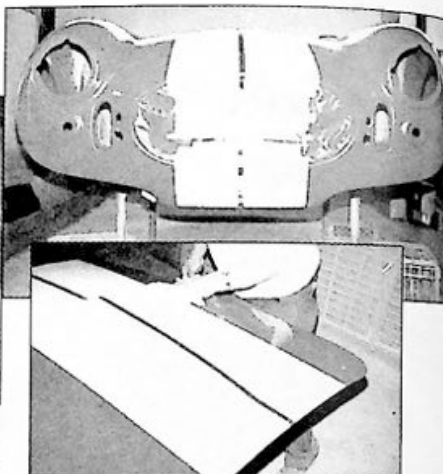
George Anderson welded up a stand out of 1½-inch steel pipe to support the body during prepping and painting. He also built an A-frame lifting device for removing and installing the body, a task that had to be done about 20 times during assembly to make sure everything fit properly. He recommends that the holes for the bumpers, headlights, heater hoses, seats, and so forth be drilled and fitted before painting.



To simplify the assembly, the Andersons purchased a rolling chassis kit, shown here being pushed onto a trailer by Bob Kallio (far left) and crew.



Because the fiberglass body will flex a bit after it's mounted on the frame and the engine weight is added, it's a good idea to do some dry fitting before painting. After that step, Anderson had the body shot with Mercury Capri LeMans Red and Ford Probe Performance White. Here the hood's clearcoat is being polished. He suggests keeping these components well wrapped until final installation, and he recommends making note of the location and number of spacer shims needed on the hinges so the hood, doors, and trunk will fit as they did before the body went to the paint shop.



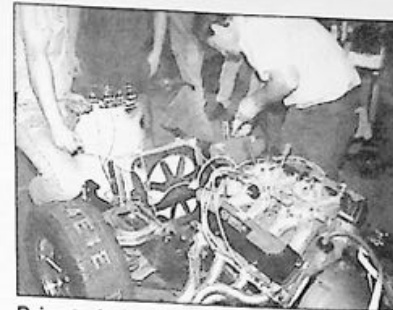
MidStates cut the holes in the dash for the gauges. A professionally fabricated harness, such as the one shown here from Dr. K's with every wire marked, makes this part of the job much easier, as only a few basic wiring tools are required. Most of the routing holes were drilled and most of the mounting tabs installed prior to body painting.

chassis with the body mounted and fitted with the doors, the hood, and the trunk lid. Underpinnings included a Mustang II front end and a four-link '78 Ford 9-inch from a Lincoln Versailles.

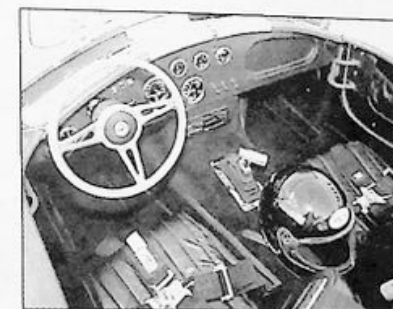
As for packing that wallop, Anderson had been collecting Ford FE big-block parts for years and already had a beefy NASCAR forged and cross-drilled crankshaft and a lean set of Le Mans connecting rods, polished and shot-peened for heavy workouts. Dove Manufacturing supplied some coaching along with an aluminum 2x4-barrel Tunnel Wedge intake and aluminum medium riser heads (with the intake ports aerobically to a healthy 2.250 inches for the Childs & Albert valves).

The aluminum pieces alone trimmed 85 pounds of ugly fat. Anderson also installed a Competition Cams 33-782-8 bumpstick (the company calls it "the ultimate street cam") and roller lifter package with a net lift of .675 inch. The 427 block was still standard bore when Anderson picked it up, and he flexed it to accept a .015-over forged 10.5:1 TRW piston (L2244F-015) with .005-file-fit Plasma Ceramic rings (T9138-005) and Federal-Mogul Performance Bearings. And just for good measure he buffed out the block with an Aviaid oil pan and a set of Stellings & Hellings air cleaners with the original blue stickers on top.

This engine workout was not without a few strains. Anderson's machine shop does the lion's share of balancing work in central Nebraska,



Prior to being installed on the chassis, the 427 was fully assembled with headers, an expansion tank, and air cleaners. With the engine bolted on the bare chassis and the dashboard with instruments set on a barrel, Anderson and the Gessford crew did a test run for 30 minutes at 2000 rpm. He says it was the best day of the entire project—hearing 600 ponies roar to life and dreaming about the first test drive.



To accommodate George's lanky frame, the floorpans were dropped 4 inches.

and his crew gave this block precise tolerances (it was for the head trainer, after all). But the 1½-inch pushrods were too long and had to be replaced, and a clay test revealed the piston-to-valve clearance was tight, so the crew fly-cut the pistons a bit more and reduced the margin on the valves, which meant rebalancing the whole shebang. Then a pressure check showed the intake manifold was a leaker, as was its replacement, so it was pressure-impregnated. No more leaks, but that wasn't the last of the hurdles.

After being bolted on the rolling chassis, the engine was ready for start-up. All the vital signs were good for the half an hour it ran at 2000 rpm. So Anderson and his crew dropped the body on, hooked up the gauges, and attached all the hardware. Once the Cobra was on the road, the temperature needle continually climbed with the exasperating persistence of a referee's 10-count. After Anderson replaced the water pump, the pulleys, the thermostat, and almost the radiator as well to prevent a meltdown, his pyrometer revealed the real problem—a bum sending unit.



To pamper his new baby, Anderson bought an enclosed, 26-foot trailer decorated with stick-on floor tile for that checkered-flag look. In addition to a Cobra enthusiast, he is also a Coca-Cola nut, so he installed a Coke machine in the front, complete with old-style bottles.

The total investment of money and time, including all the engine work, was nearly \$54,000 and 464 hours (with Anderson's buddy Steve Grummert putting in more than half that time on the engine buildup, the chassis setup, and the body mounting).

With all the snags sorted out, Anderson hit the drags with a vengeance. To date, he consistently nails the quarter-mile in the low 12s at more than 115 mph, and on street tires he pummels 0 to 60 mph in only 4.25 seconds. George Foreman isn't the only one who's found the fountain of youth. **KC**

## SOURCES

Gessford Machine Shop, Inc.  
Dept. KC11  
701 W. South St.  
Hastings, NE 68901  
402/463-9844

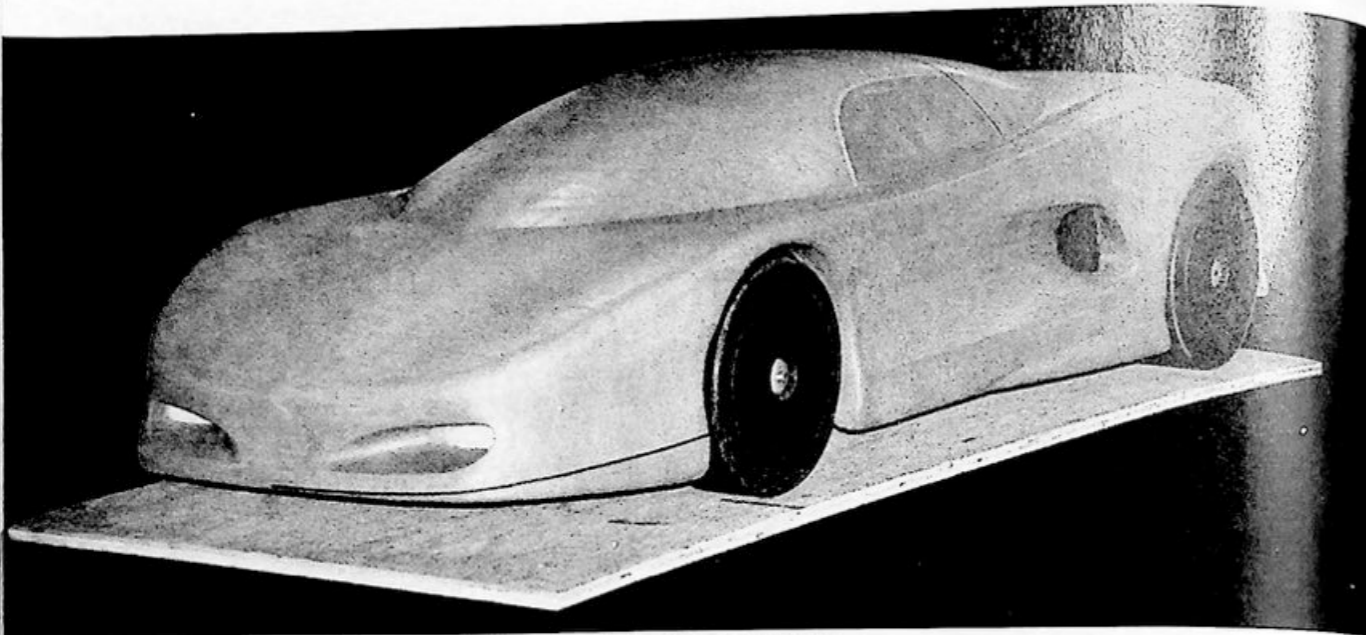
MidStates Classic Cars  
Dept. KC11  
P.O. Box 427-P  
835 W. Grant  
Hooper, NE 68031  
402/654-2772

What has 2700 hp and is seven car lengths from nose to tail? A convoy of MidStates replisnakes, that's what. They came from all over, meeting up at Firebird Raceway in Phoenix, Arizona. (Melvin and Judy Oldendorf of Beecher, Illinois, won the long-distance award.) MidStates customers are a very friendly bunch and enjoy sharing these sorts of fun runs. Earlier this year a group headed to Niagara Falls, and about two dozen MidStates cars showed up for a reunion at the MidStates factory in Hooper, Nebraska.



tailoring his products to the customer. After taking one look at Anderson's 6-foot-6-inch frame, Kallio realized this man wasn't going to fit in the cockpit without some custom fitting. He pulled out his tape measure and notepad, measured Anderson's sleeve length and inseam (now that's personal attention!), and ended up lowering the footboxes a full 4 inches. He also reduced the diameter of the steering wheel by an inch, shortened the blinker stalk 3 inches, and reworked the leather-covered seats. Another mod was the installation of a C6 automatic so there would be one less pedal to get in the way of Anderson's size 11s. Josie also liked the idea of not having to shift in heavy traffic.

The kit the Andersons picked was the \$20,000, round-tube rolling



# Frame Job

## How to Lay Out and Fabricate a Custom Chassis

By Timothy Barton

Not all kits come complete. In some cases, all you have to work with is a fiberglass body with no frame underneath it. Or maybe you have to replace the frame that's under your

current kit body to upgrade the engine or suspension. Or perhaps you even want to create a totally custom car from the ground up. Whatever the

Even though this custom design being sculpted in clay is just under 6 feet in length for wind tunnel testing, the methods used to construct its frame are the same in principle as for a fullsize vehicle.

case, you'll need to scratch-build some kind of a car frame. There are a number of ways to approach this task, but we'll show you one of the easier and quicker approaches.

Car builder Lance Carter was in charge of building a  $\frac{1}{10}$ -scale model (40 percent) of a concept car for wind tunnel testing. The scale was determined by the size of the tunnel's walls, but the principles of layout and fabrication are the same for a fullsize frame. In this case, the plan was to use the low-speed wind tunnel at Texas A&M University. The team at A&M dictated the optimum size, which left Lance with the chore of building a clay-bodied test model of approximately 5½ feet in length. Because of a tight schedule, a number of unique shortcuts were taken.

We'll let the accompanying photos and captions explain the process. One tip: Using new photo and print technologies will make this job a

whole lot easier. Find out who does the best color photocopy reproductions. Locate a camera shop or school that will rent out an overhead projector. Learn how to turn photos and drawings into a transparency that can be projected onto the wall. Nail or tape large sheets of foam board to your shop wall to make a cheap, full-size projection screen.

Also, buy a basic mechanical drawing set. Tape a large sheet of butcher paper onto a drawing table (you can construct one out of plywood and Formica) and learn to do  $\frac{1}{4}$ -scale, geometric drawings. We cannot overemphasize the importance of experimenting with your job on

paper first to save time in the layout and mock-up phases of the project.

One more approach for saving time: Find an architectural engineering firm that has a photocopier capable of making 3ft-wide blowups. After doing quick,  $\frac{1}{4}$ -scale drawings, you can use these large photocopy machines to print out the fullsize blowups accurately and for only a couple of bucks apiece.

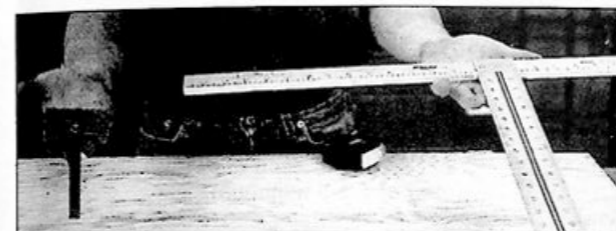
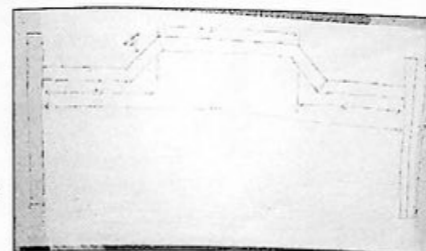
Obviously, you will want to do a physical layout during the drawing stages. A physical layout simply means moving the vehicle's engine, transmission, and full suspension assembly (along with the wheels, tires, seats, steering wheel, and the

driver and passenger) into their relative positions first. You can do this on a table or on the shop floor. It is sometimes best to build a plywood base and mount everything onto it first, so that all dimensions are held and measured more accurately.

At some point you will have a full-size drawing that you are ready to make into a welded, tubular-frame structure. How do you get all of those sections of tubing to point in the right direction at the same time? Our photo sequence will walk you through all of the steps in the fabrication process.

A few hints—when using metal tubing on a job like this, wash the tubing thoroughly with acetone or

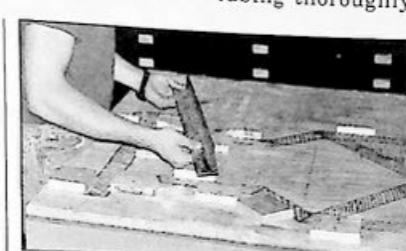
With the projector light turned off, you can better see one side of the ladder frame that will be constructed. Lance only drew one side of the frame to save time, as the other side of the frame is just a mirror image anyway. By projecting the overhead drawing in the desired scale, you can be confident that your frame will clear the wheels and tires as well as the outer body envelope.



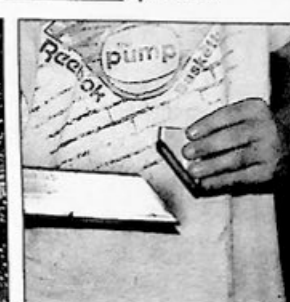
The normal first step in building a frame-welding fixture is to glue your fullsize drawing to a piece of plywood. In Lance's case, because the layout was relatively simple, he chose to make the final drawing directly onto the plywood rather than attach the butcher paper. A carpenter's pencil, a T-square, an angle finder, and measuring tape are all you need to draw on the wood. A pencil compass is sometimes helpful.



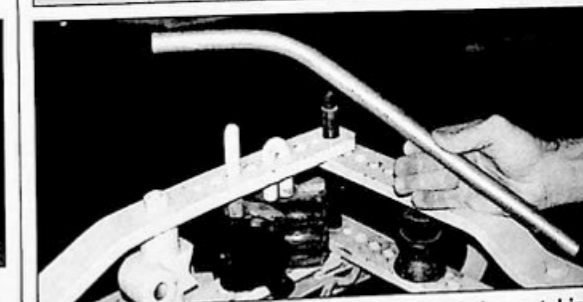
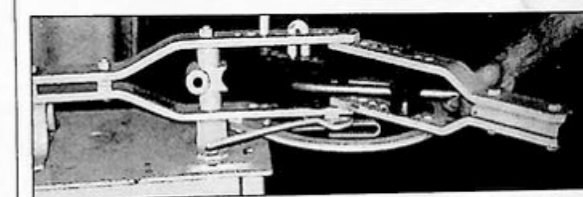
Once the frame is sketched on the plywood, use an electric drill or cordless screw gun to quickly attach sections of 1x4-inch pine. These wooden locators will hold the tubes in place during the fitting and welding process. Because Lance's car will have a clay body weighing a couple of hundred pounds, and because the air pressure in the wind tunnel will add even more load, he included an X-member in the center of the frame for torsional rigidity.



Not every section has to be box tubing. Other shapes can be used as well. Here, an angle profile section is cut and placed into position.



A chop saw costs a couple of hundred dollars. Get one with a 14-inch-diameter blade. A dropped shelf has been added to this workbench for the saw. Notice how a miter cut is achieved. A few seconds later, a clean, crisp edge is ready for welding.



If the frame you're fabricating requires curved pieces, tubing bends can be accomplished with this Hossfeld bending machine. Any shape of metal profile—squares, rounds, rectangles, angles, Ts, bar stock, and so on—can be bent as desired in place of miter cutting and laid into a plywood fixture. Muffler shops are a good source for emergency bends as well.

NOVEMBER 1995 65



Car builder Lance Carter used an overhead projector to display a top-view drawing on 3ft-wide butcher paper taped to a wall. A simple drawing was photocopied onto a transparent sheet and then projected. You may alter the size (scale)



of the drawing by simply moving the projector closer or farther away from the wall. After determining the exact scale with the projector, Lance began to sketch the ladder-type, tubular frame into place.

# Frame Job

lacquer thinner and paper towels to remove all of the surface oil. Keep your work area spotless. Always have a fire extinguisher and water supply handy, and keep all sawdust swept and vacuumed away from any area where metalwork is taking place. Keep your hands clean as well.

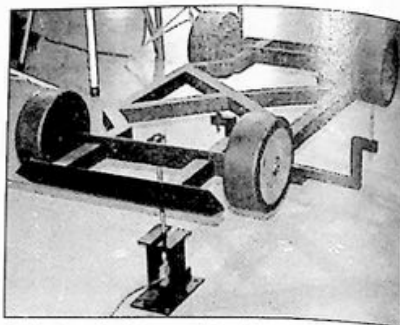
One more thought about this method of tooling up to build a vehicle frame in a plywood fixture. After you have completed the job, if you want or need to change anything on the finished frame for any reason,

simply modify the wood former, cut the tubing, and make the desired modification. It is great to have a wooden production tool as a fixed frame of reference. The real beauty of having a wooden fixture like the one illustrated is threefold:

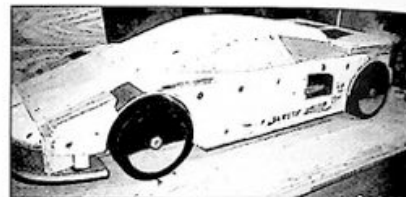
- You will have a highly accurate, welded frame assembly when finished.
- Construction time is very fast, and the design itself is very versatile.
- After approving the finished project, you can use the wooden fixture to produce a number of examples with highly accurate tolerances from frame to frame.

Even though a small-scale frame is the subject of this article, the recom-

mended tools and techniques can be applied to virtually any kind of automotive tubular structure. Most jobs are easy once you know the tools and procedures.



Prior to wind tunnel testing, solid wooden wheels are added along with threaded rod axles. Three mounting rods go through the wind tunnel floor. These will suspend the car in the air stream with the least amount of disturbance. The device on the floor is a strain gauge for measuring aerodynamic loads at one end of the car.



After the frame structure is completed, a wooden inner body structure, or armature, is attached directly to the frame. A few pieces of foam are added as well to keep the actual clay thickness to a minimum.



After coating and treating the wood and foam surface with orange shellac, a hot, oil-based, automotive styling clay is slowly built up in layers over the armature. The body shape is then carefully sculpted. Once the ideal shape has been established, the clay buck can be used to create fiberglass molds or a one-off body. **KC**



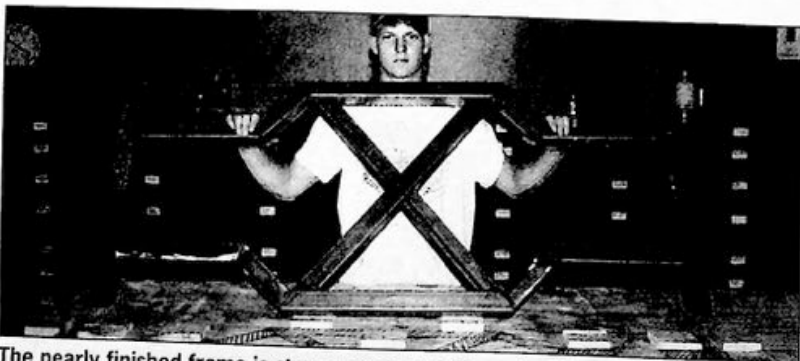
Lance began tack welding the pieces together after the last piece was positioned in place. He put a tack on three sides of every joint section to help control weld distortion when doing the finish welds.



Finish welds follow tack welding. Just like torquing engine head bolts in a certain sequence, you must also alternate weld beads in a pattern to control the overall distortion of the finished frame.



Use a 4-inch, hand-held, high-speed sander to deburr the welds quickly and cleanly.



The nearly finished frame is strong, neat, and dimensionally accurate. A few completion welds are still needed at this point.

66 KIT CAR

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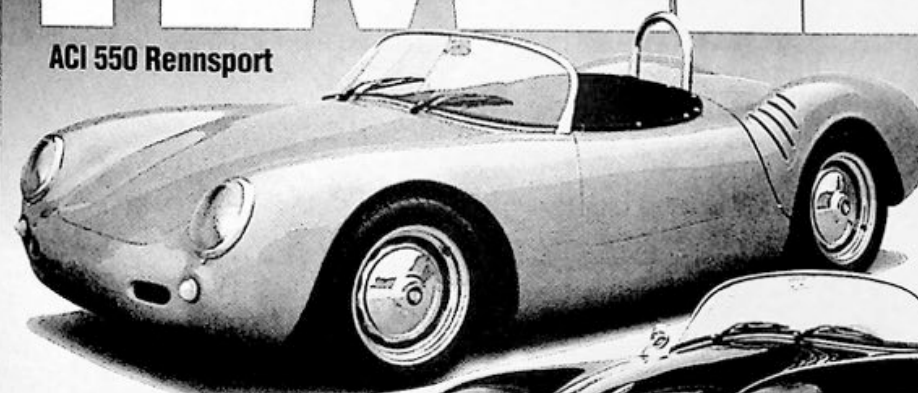


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# REPLICAS

# WEAPONS GRADE

The Scorched-Earth Policy of the Kurtis Kraft 500S Continues On With Arlen, Son of Famed Frank Kurtis



PHOTOGRAPHY: ERIC RICKMAN

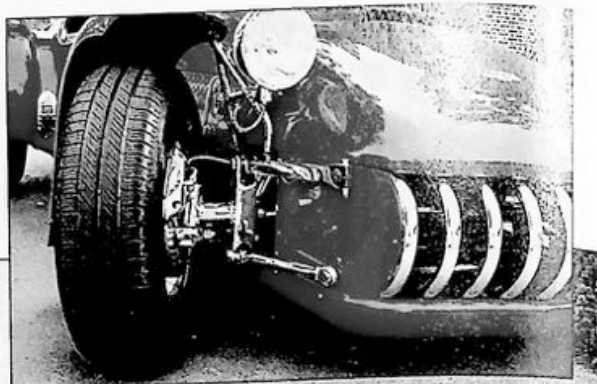


By Eric Rickman

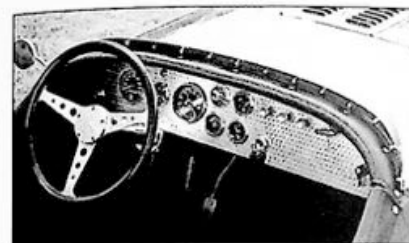
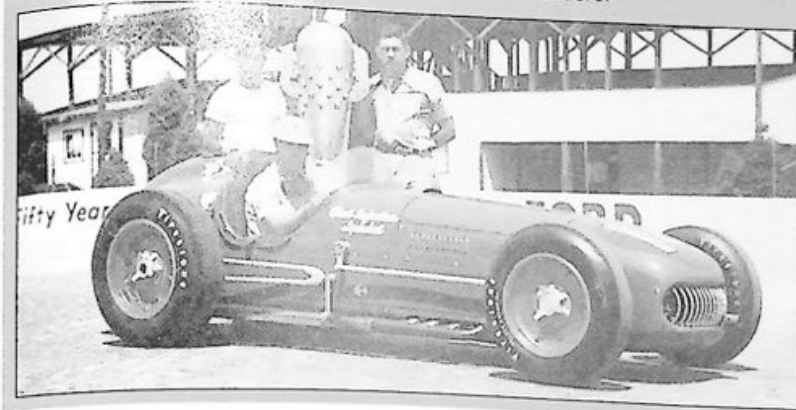
**A**fter Frank Kurtis drove a Cad Allard for the first time in 1953, his blunt assessment was, "Hell, I can make something that works better than this." And so he did.

Frank was a world-renowned builder of winning race cars, Indy 500s, Midgets, Sprint cars, and even go-karts at one time. After climbing out of the Allard, Frank went back to the shop and built a duplicate of his 500S that had won the Indianapolis 500 in 1953 and 1954 with Bill Vukovich driving. Thus was born the first of the Kurtis sports cars: the Kurtis Kraft 500S. The car was built identically to the 500S from the firewall forward, the only exceptions being the motorcycle-style fenders and the Dietz headlights.

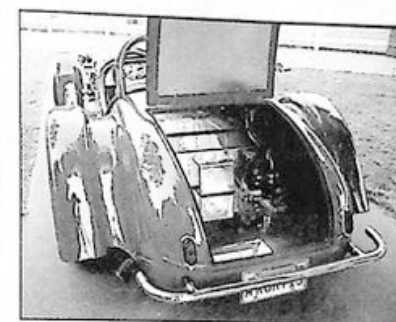
In the race car's cockpit, though, the driver was offset to the left of the driveshaft, with the right side housing fuel



The KK-500S evolved from the Indy-winning Kurtis Kraft Special shown here with driver Bill Vukovich behind the wheel. It was a hybrid, a dirt-champ car capable of running at the track. The rear axle was located with wishbone radius rods. (It was modified to the leading-arm suspension in the next generation of cars.) To create the 500S model, Frank added headlights, redesigned the cockpit for a passenger seat, and reworked the entire rear section for fenders.



The machine-turned dashboard evokes the right era.



Even the trunk is finished out with polished panels.



Arlen is also still producing Offy-powered Midget cars, which raced in the '40s.

and oil tanks. Frank removed the tanks to provide passenger space. The bodywork from the cockpit aft was fiberglass, and Frank merely reworked the mold to produce a rear section with fenders and provision for trunk space. He then made smaller fuel and oil tanks to fit the newly shaped tail section; large fuel capacity wasn't needed in these cars. With the addition of a second seat, he now had a street-legal sports car built on the original, unaltered winning race car's chassis and running gear. Although no records were kept, he built two dozen cars before ceasing production in 1955.

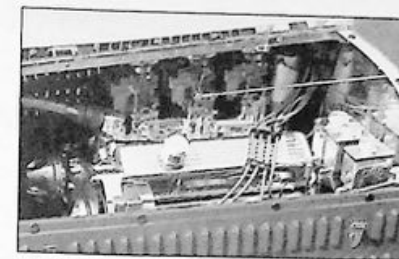
When Frank died in 1987 his son Arlen took over the business, making chassis and parts for building and restoring early Kurtis Midget race cars. The company was also involved in the design and construction of start carts for the Lockheed SR-71 Blackbird, the world's fastest aircraft. Arlen developed as well a line of high-performance boats for drag racing and water skiing. One of them, built for Eddie Hill, set a 229mph record as the world's fastest propeller-driven boat.

An owner of one of the original KK 500S sports cars damaged the car in a vintage race and sent it to Arlen to

be repaired. This gave Arlen the chance to construct a chassis-building jig from an original car, which he needed because his father's jigs were long gone.

Arlen has built 12 of these chassis, continuing the serial numbering of the cars his father built. Arlen's personal car, featured here, is stamped KK-500S-36. His continuation cars are even better than the originals built back in the '50s, as both metalurgy and engineering have advanced considerably since then—not to mention engines.

The suspension is the original four-torsion-bar setup, with trailing arms in front joined to the tubular one-piece axle. The rear has a leading-arm suspension on a Speedway



An Edelbrock intake and Dart II heads pump up this 5.7-liter Chevy's output to 425 hp.

Super Max quick-change center section, and Monroe shocks are used all around. The wheels are original Halibrand race car magnesium knock-offs. Four-wheel disc brakes are equipped with late-model, four-piston Wilwood calipers.

This car has a triple dual-throat carburetor setup with progressive linkage on an Edelbrock intake manifold mounted on a 5.7-liter Chevrolet engine. The transmission is a T5 Borg-Warner five-speed coupled with a McLeod clutch and flywheel assembly. The car is designed to accommodate almost any engine and transmission combination a customer might desire, including a copy of the original four-banger Offy engine that won the Indy 500 many times.

The fire-control system required by USAC on race cars is retained in this car. A large tank of Halon is piped to nozzles in the engine compartment and under the dash, and the emergency actuating handle is on the dashboard.

As further confirmation that Frank proved his point about the Allard, two of these cars placed First and Second in a recent cross-country Mexican Road Race. And Arlen's personal car took home four awards from the AHA car show at Knott's Berry Farm in Anaheim, California. Not too shabby for its first show.

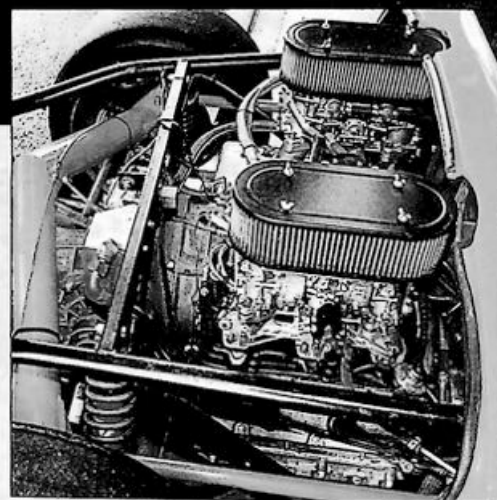
Arlen's huge shop at his home in Bakersfield, California, is equipped with everything needed to build the KK 500S cars. Arlen runs it as a one-man operation since he's semi-retired, so be advised that your car would take about 18 months to build. The car you see here is valued at approximately \$85,000, and prices vary depending on options and the customer's requirements. No, they don't come cheap, but weapons-grade winners rarely do. **KC**

## SOURCE

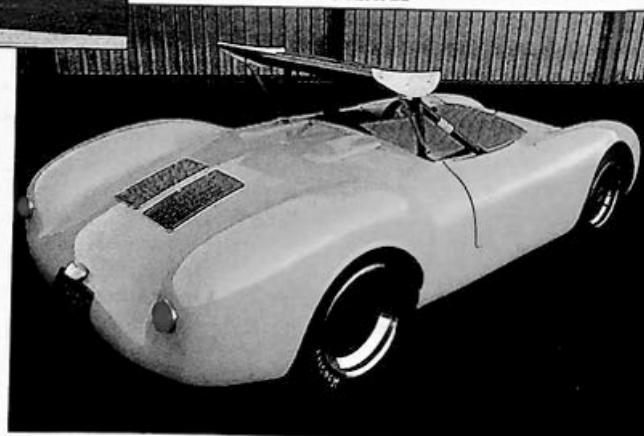
Frank Kurtis Co.  
Dept. KC11  
6631 Rivergrove Dr.  
Bakersfield, CA 93308  
805/393-7706

# Heating Up a Beck 550 With a 430hp Porsche Powerplant

## Yellow FEVER



PHOTOGRAPHY: STEVE TEMPLE



By Steve Temple

Maybe Darryl Springer is related to Jerry Springer, that TV talk-show host who trots out a really outrageous assortment of scoundrels, all hot-tempered and hot-blooded. We're really only kidding about this family tree, but for good reason: Darryl's yellow screamer is one of the most antisocial incarnations of the Beck 550 we've ever seen. You see, he couldn't care less about a civilized street car (although this car is in fact street-legal). He'd rather flaunt every speed limit in the land—and has been regularly doing so on roadcourses for the last 25 years. Chuck "Hot Shoe" Beck of Beck Development is sympathetic, having turned

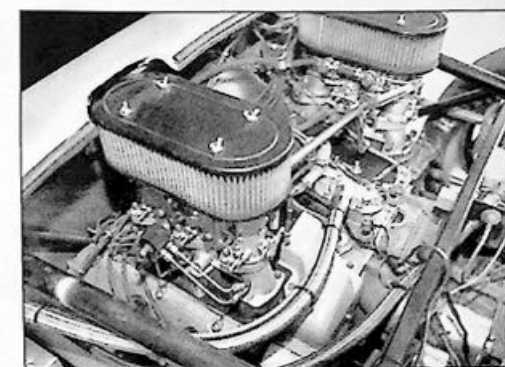
more than a few wrenches in the pits, and he routinely embarrasses the Cobra fraternity with the performance of his VW Bug-powered 550 and Bow-Tie Lister (see "The Anti-Cobra," November '94).

For Darryl, though, Chuck had to work up something a little extra, not only in the engine bay but also in the rear suspension. Typically, a plain-vanilla 550 employs a VW Type III driveline with the ring-and-pinion gears swapped on the swing-axle rearend for midmounting the four-banger. But on Darryl's zonker Chuck hopped up a six-cylinder, 3.2-liter mill from an '86 Porsche 911 with Cosworth 11:1 pistons, port work on both the intake and exhaust, high-performance cams, and a brace of 46mm Webers. Oh yes, there's a bottle of NOS laughing gas up front as well, which gooses the output from about 300 to 430 hp. And that's on a car that weighs only 1500 pounds soaking wet. The gearbox is a 901-series from a Porsche 914, but the gear stack is totally reworked for maximum acceleration on a roadcourse.

A de Dion setup stiffens up the rearend by linking the Porsche 944 hub carriers with a massive, 3-inch round tube. Also, custom-fabricated triangular bellcranks attached to radius rods ensure that the suspension moves directly up and down (they function the same as a transverse Watts link, but this piece would have to clear the transaxle, putting the roll center too high). Koni coil-overs replace the standard spring plates. The fender flares are 3 inches wider for the P275/45R16 rear meats. In the front, the narrowed VW torsion-bar unit turns P205/50R15 rubber.

When asked about the performance of his car, Darryl gets almost as animated as one of Jerry's wild-eyed talk-show guests, and justifiably so. He recently knocked a full 5 seconds off the class record at an SCCA Pagoda Hill Climb event in Reading, Pennsylvania, previously set by a Cobra replica. And his best banshee wail through the quarter is 11.1 seconds at 123.5 mph, and that was on street tires. With slicks, the car rips from 0 to 60 mph in just 3.66

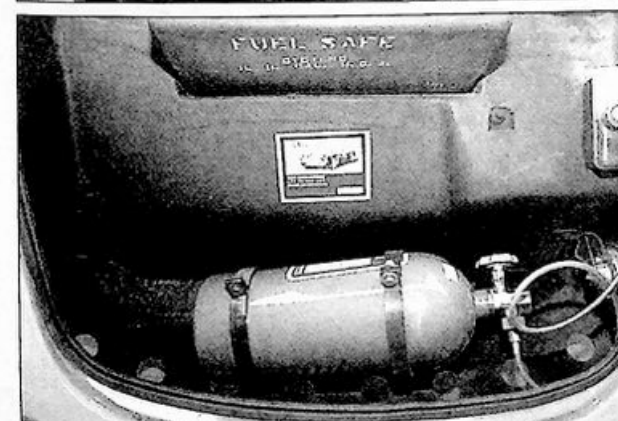
seconds. Darryl says the wing, custom-fabricated by Good Racing Products, adds about 10 to 15 mph on high-speed turns, but swapping the windshield for a plastic deflector made the biggest difference in keeping the body from getting light at speeds above 140 mph. The best top end he's seen is 165 mph, but he figures he could hit 200 mph with the right gearing. Let's see Jerry try to top that on his talk show.



Fitting the 46mm Webers required a bit of clearancing for the air filters.



It's a snug fit in the cockpit with the addition of a rollcage and aluminum hard-tonneau cover for the passenger side.



Chuck Beck designed a unique airflow system for this particular vehicle. The vents and extra holes in the nose, directly ahead of the nitrous bottle, suck air into the compartment. The air then exits through ducts on each side of the fuel tank. These ducts run through the rocker panels to the back of the cockpit, behind a double-layered firewall, then directly into the engine intake.

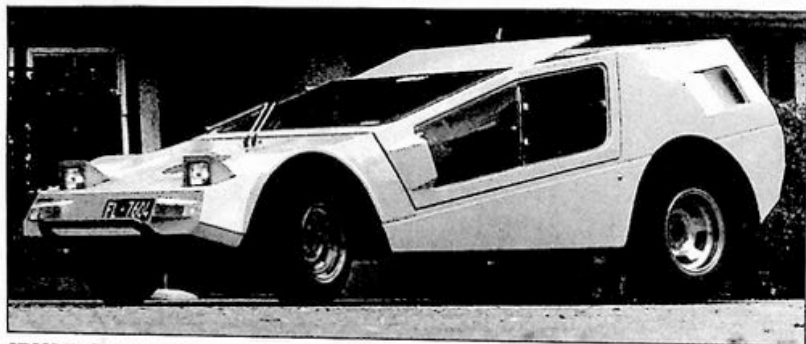


Just behind the de Dion tube are Beck-fabricated triangular bellcranks with gear teeth joining them. When a radius rod on one side moves one of the bellcranks, it transmits this motion through the gear teeth to the other crank and radius rod, so the suspension moves in unison. **KC**

### SOURCE

Beck Development  
Dept. KC11  
1531 W. 13th St., Unit E  
Upland CA 91786  
909/981-3840

# DUMB AND DUMBER



## JEHL SAPHIER

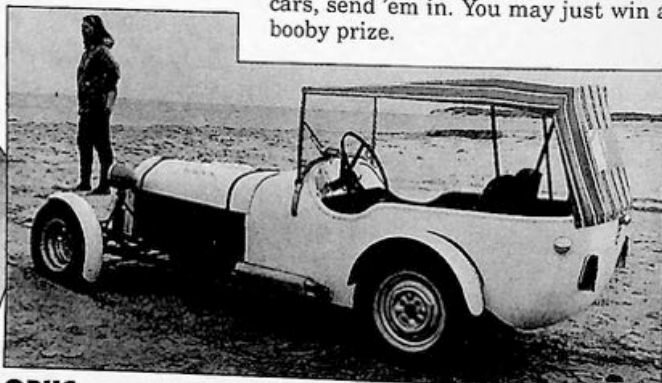
In Switzerland they make strong cheese. In the tiny, neighboring principality of Liechtenstein, they make cars that look like wedges of cheese. This curious, VW-based Dustbuster was also offered with midmounted V8 power, quoted at 500 hp. Sounds a bit cuckoo? Well, they do make cuckoo clocks in Liechtenstein too...



## PEEL P50

This is the world's smallest car, the '62 Peel P50. Made on the Isle of Man off the coast of Britain, it was nothing more than a chair in a box on wheels. Each one was shipped to its new owner in a crate that doubled up as its garage. Can you imagine pulling up to a four-star restaurant in this? The parking valet would refuse to get behind the wheel.

72 KIT CAR



## OPUS

Hot rods and dune buggies are two great American inventions. This is what happens when an Englishman on a wet beach tries out the ideas. The Opus (which ironically looks like the cartoon penguin of the same name with the funny nose and big rump) was offered in 1966 by two famous chaps who ought to have known better: designer Neville Trickett (he did the GP Spyder) and race driver and financier Rob Walker. The model in the background was probably relieved the beach was deserted of onlookers.

## Weird 'n' Wacky Kits, or Answers to Questions Nobody Asked

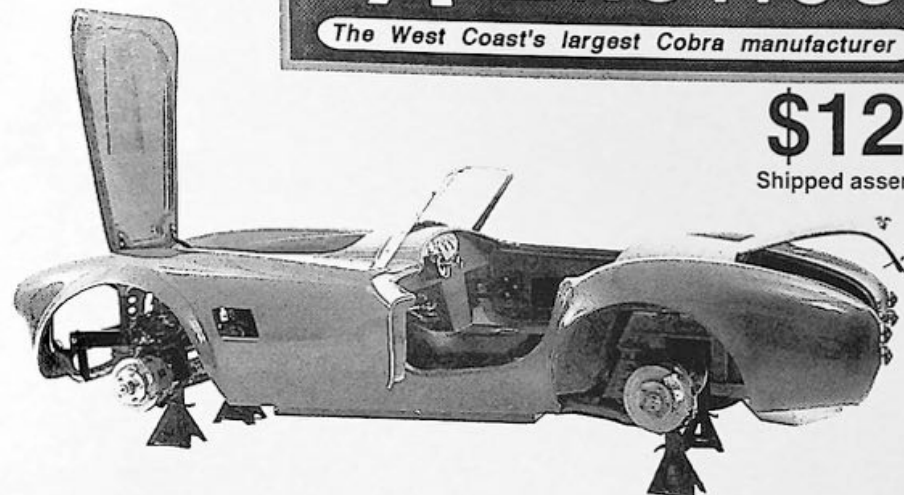
By Chris Rees & Steve Temple

What was once a vice is now a habit. It started out as merely idle curiosity but has festered into a sick obsession. We actually like digging up bizarre and deservedly defunct kit cars; may they never rest in peace. It all began with an auspicious—or rather suspicious—presentation of "The Not-So-Good, the Bad and the Ugly" (May '95), a confounding collection of quirky conveyances. But now we can't let go of these twisted things. We scrounged around in our files—we're ashamed to admit we've actually been saving these photos for some perverse reason—and we also received in the mail a package with a plain, brown wrapper. No, it wasn't from the Unabomber, although it might as well have been. Our lug nut in England, Chris Rees, had dispatched to us his prized photo collection of, well, *unusual* Brit kits. (He actually admits to having owned more than one of these atrocities—we may have to fire him.) Anyway, we're beginning to think we might need professional help to cure us of this disease. Be afraid, be very afraid—you don't know what we might do next. In fact, we hunger for more of these atrocities, so if you have any photos of weird 'n' wacky cars, send 'em in. You may just win a booby prize.

PHOTOGRAPHY: CHRIS REES & STEVE TEMPLE

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# DUMB AND DUMBER



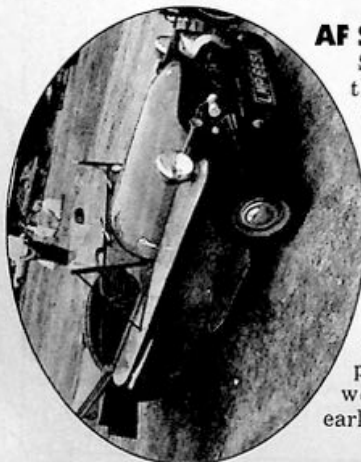
## BOND BUG

Chris Rees admits that his first car was a Bond Bug. It was cheap and attracted a lot of attention—unfortunately the wrong sort of attention. The jokes flew when he had it: "Where's the other half, mate?" "Don't go up a hill, or it'll turn into a rocket," and so on. We liked the caption on the press release photo best: "A funabout for youngsters who know how to enjoy life." (As long as you happen to be a masochist. Chris, is there something you're not telling us?)



## MARCOS MANTIS

Even its most ardent fans are bound to admit that the Marcos Mantis is pig-ugly. Its slices-of-bacon styling failed to win many hearts back in 1971, but today, because of its curiosity value and rarity (only 32 were built), it has a devoted cult following. Perhaps Mantis fans are impressed by the engineering marvel of using door seams as intake vents.



## AF SPIDER

Someone once described this trike as a wardrobe on wheels. Its wooden construction and Jules Verne-style fenders made it the sort of car that inspired schoolboys to ask how fast it would go in water. Quite a few of these pointy-tailed devices were made in the early '70s.

## TICI

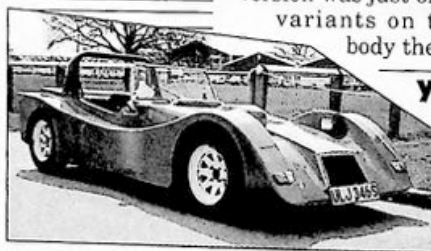
Rees also confesses to having owned one of these. It was called a TiCi (pronounced "tichy"), and it was just 6 feet, 6 inches long. It had a Mini engine in the tail, which produced such wayward handling traits that his touchy TiCi ended up demolishing a wall backward. A passerby looked at the brickwork and said, "You've done him a favor there." Rees says that was not much of a consolation. (Actually, the wall probably did the TiCi a favor.)



## BAMBY

Disney's cute and cuddly baby deer would probably freeze in the headlights of this British microkit, but not from fear. More likely from bewilderment. The Bamby was built in 1983 with a 50cc moped engine and, strangely, a single gullwing door. The creator actually sold 50 of them,

although it is believed that many were turned into kiddie pleasure boats.

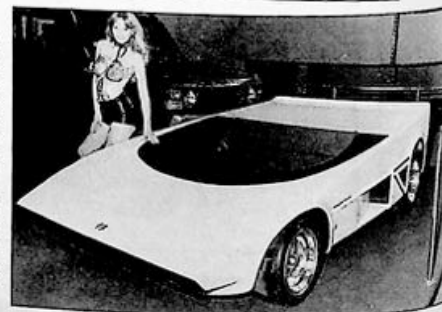


## YNOT

"Why?" might be a better title. This contorted mishmash of a car was a one-off, or so we all thought—and hoped. A couple of years later, it was proudly launched as a kit car under the name Spirit. Perhaps that is because spirits must have been involved in the decision to make it.

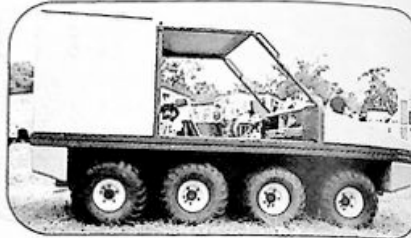
## MIDI

The year is 1978, and it's the British Motor Show. The car is the Midi, whose lines are suggestive of a doorstep or the victim of a steamroller. History does not record the name of the girl standing beside it or quite what she was doing there.



## STIMSON SCORCHER

You can't get much more wacky than this—three wheels, exposed engine, ride it like a horse, fumble between your legs to change gears. The British powers-that-be had trouble deciding whether to class it as a motorbike or a car. In the end they defined it as a motorbike and sidecar. Does that make sense? Somehow we don't feel right even asking that question.

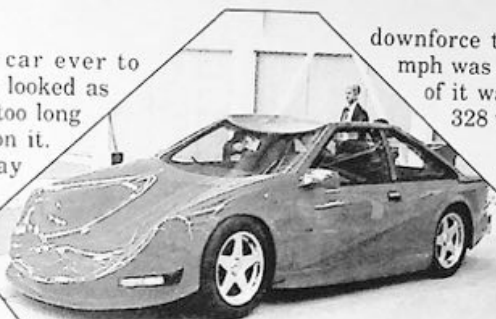


## HUSTLER

Would you believe this boxy caterpillar was designed by the same man who brought you the Aston Martin V8 and the Lagonda? William Towns had a neat little sideline with his kit-built Hustler. This amphibious version was just one of 72 different variants on the same basic body theme.

## ZLATKO

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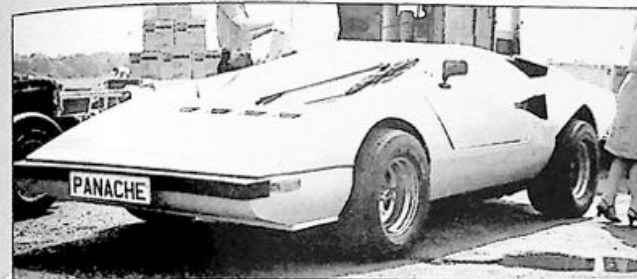


downforce that a top speed of more than 200 mph was possible. The most excruciating part of it was that Zlatko chopped up a Ferrari 328 to create this traffic accident.



## BALLCAR

A 1982 folly from Italy, possibly produced at a couch factory, the Ballcar was crafted from a solid hunk of wood and was adorned with expanded-foam trim. The two passengers were supposed to sit with their heads resting on bath sponges. Fittingly, the Ballcar was, like its creator's brain, a nonrunner.



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# DUMB AND DUMBER



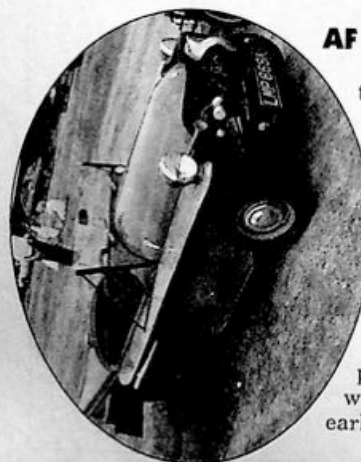
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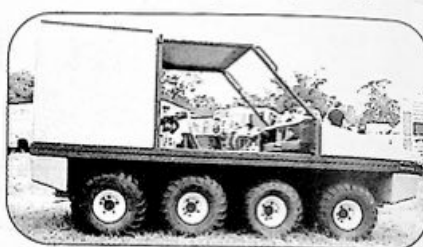


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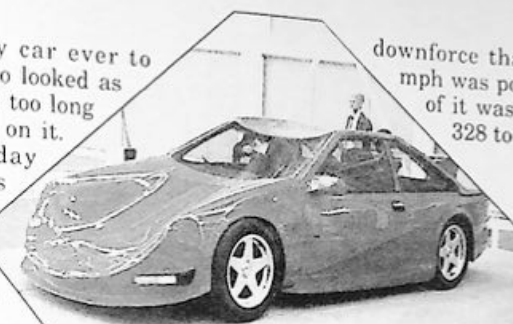
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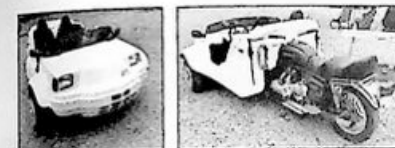


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## SPARTA

It's rumored the inventor of the Sparta was inspired on a golf outing when a motorcycle crashed into the back of his cart on the way from the 19th hole. We just wonder who gets to steer. If you really insist on finding out more, contact Pressler Motor at 219/533-2842.



## NIPPY

Yes, it's awfully cute, but think about how many cars would be nipping at the heels of the Nippy if it ever ventured out of the driveway. We're told the engine was rejected by Singer Sewing Machine for lack of power.



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This was a vain attempt to turn the Mercury Bobcat into a roaring mountain lion. Well, the Stiletto certainly is longer, isn't it? Now all it needs is a 6ft overhang in the rear to match the front.



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## EXTRAVAGANZA "WIDE RIDE"

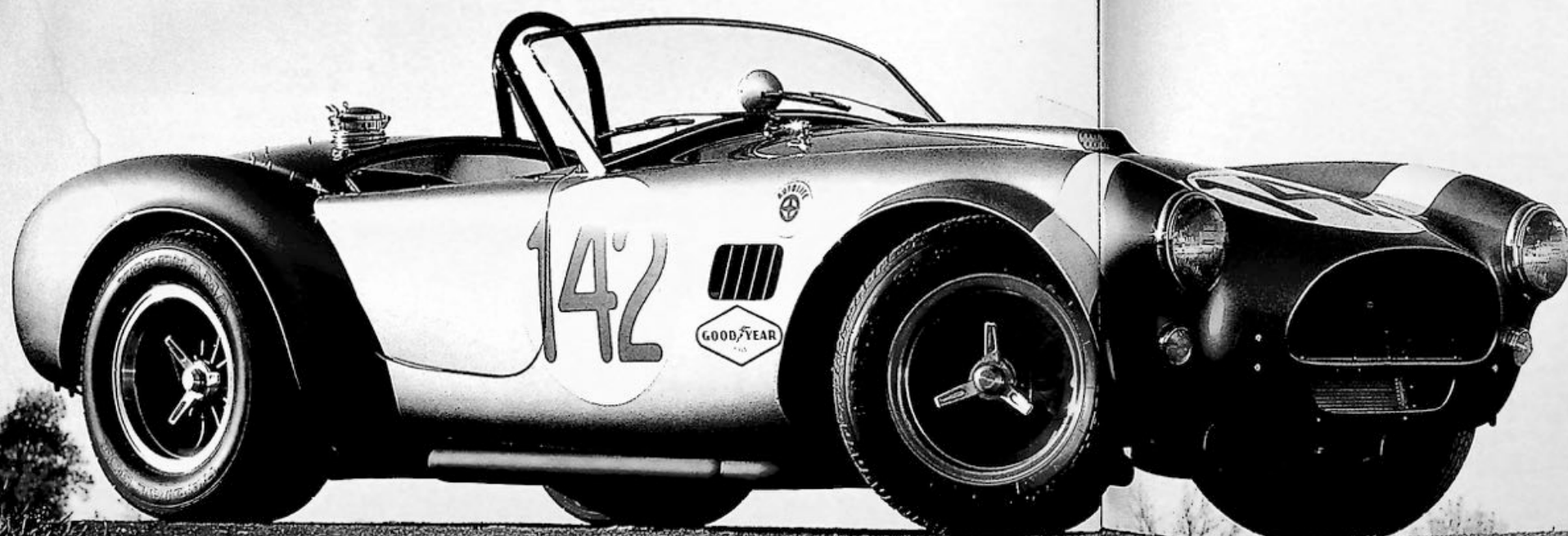
Finally, a car Brando could fit into. Try passing this one on a narrow country lane. We're not sure what designer Jay Ohrberg had in mind here, but we hear it takes at least a dozen Fiero donor cars to build it. **KC**

## NO NAME

It's Cobra meets Tilt-a-Whirl in this one-off creation. No, the back end is not broken—it's supposed to help you lean into turns. The owner was not present due to injuries sustained after being thrown out in a sharp curve.

# Period Pie

ERA Recreates a Significant  
Slice of Racing History With Its  
New 289 FIA Cobra



By Steve Temple

When Carroll Shelby introduced his first Cobra to the press in early 1962, his stated goal was to produce the fastest production sports car in the world. He had a much bigger ax to grind, though. He also wanted his lightweight roadster, when outfitted in racing trim, to stomp the European competition—and especially Enzo Ferrari who had once snubbed him.

The most historically signifi-

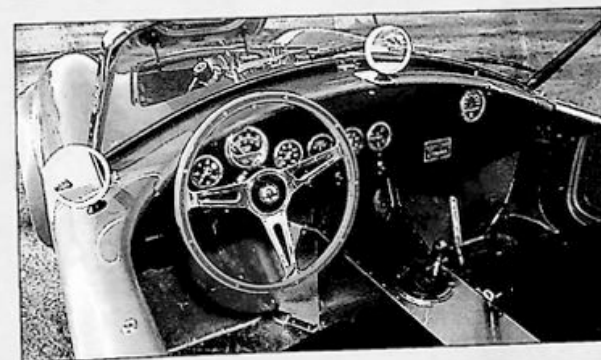
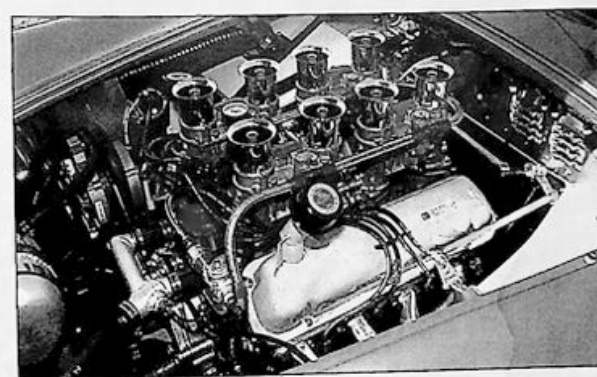
cant of these competition Cobras was the 289 FIA roadster, built expressly to compete on the roadcourses of Europe for the World Manufacturers Championship. The main differentiating characteristic from the 289 street car was the wider and more prominently flared rear fenders, because 8½-inch-wide rear wheels would eventually be used along with larger tires. These fenders required modified cut-back doors. The front fenders were also flared out at the top,

but later cars received 427-style front fenders. Perhaps the most distinctive marks were the hard corners added to the rounded trunk lid to accommodate the FIA "suitcase," a contrivance of the rules for the GT class.

Hard-core Cobra enthusiasts live and die by such details, as do replica buyers who insist on historical accuracy. Era Replica Automobiles (ERA) knows this fact as well as or better than any Cobra replicator, having produced hundreds of 427SC Cobras



PHOTOGRAPHY: JIM YOUNGS & BOB PUTNAM



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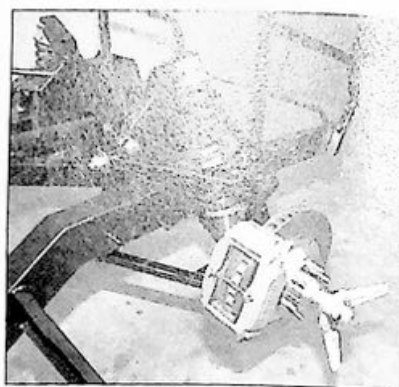
## Period Piece

and GT40s during the last 25-plus years. To round out its line, the company has gone to great pains to reproduce the highly prized 289 FIA Cobra, the one that whupped Ferrari on his own turf. ERA's Phil Gaudette traveled thousands of miles to track down CSX2345, in storage since the end of the '65 racing season and still bearing stone chips, dings, and all. (We've seen snapshots of the car, and they give new meaning to the old racing expression "rode hard and put away wet.")

According to Gaudette, it was the only FIA roadster campaigned by the Shelby team in 1965 (the others having been sold to privateers). In addition, it is the only FIA Cobra in exactly the same condition today as it was when raced by the Shelby team. All the other team cars were wrecked at some point, and many were modified during repair and restoration.

ERA's FIA clones just about every conceivable detail, from the puke tank in the engine compartment to the curved rocker panels to the quick-jack bumpers. Even the bug deflector and the hole pattern in the hood's scoop's air diffuser plate have been meticulously duplicated. To split hairs even more finely, ERA will offer all three phases of the FIA car, which differed slightly in the fender flares. Also available are a slightly more plush street model and the USRRC version that differed in the dashboard, driver's seat, wind-screen, fuel-filler splash guard, and trunk lid (no corners). This particular car's 289 block is topped with 48mm IDA Webers and mated to a four-speed Top Loader.

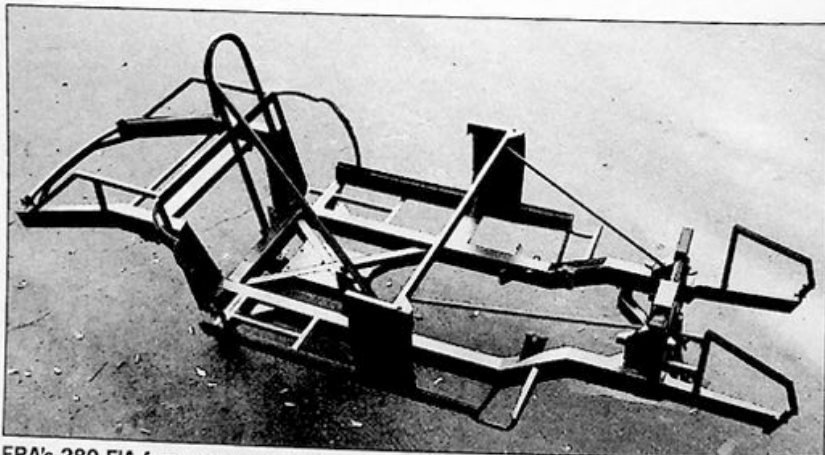
We should point out, however, that even with all these historically accu-



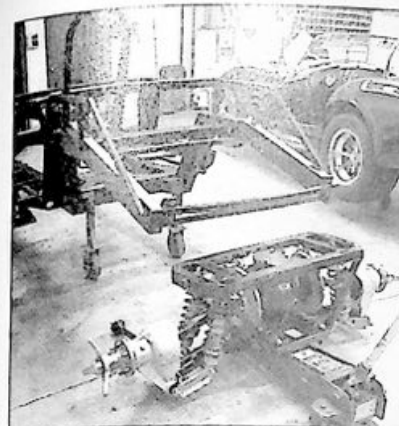
While the front A-arms are custom-fabricated, the rotors and calipers are late-model GM pieces.

rate details, there's an ironic twist to this replica. Underneath all the earmarks of authenticity is a chassis substantially modified from the original leaf-spring, 3-inch, round-tube setup—but for good reasons. To increase rigidity and reduce body shake, the frame employs 3x4-inch rectangular tubing with a boxed X-member in the center. Also, adjustable coil-overs replace the transverse leaf springs of the original. Actually, the chassis is virtually identical to the one used on ERA's proven 427SC model, but with a narrower track achieved by a change in the wheel offsets. As we've noticed on other ERA Cobras we've driven, the handling of the 289 FIA is sure and the chassis is devoid of rattles.

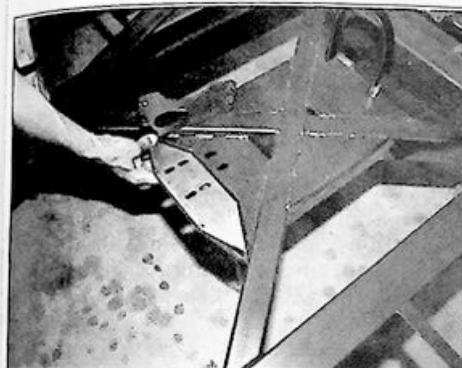
Speaking of affordability, an original 289 FIA car would probably run several hundred thousand dollars (assuming one ever came up for auction), while ERA's standard assembly package starts at \$14,900. To this kit the builder will need to supply the drivetrain, exhaust system, steering components, wheels, tires, and various suspension pieces (except for the



ERA's 289 FIA frame preserves the proven features of the company's 427SC Cobra, with rectangular tubing and a central X-member for increased torsional rigidity. The rollbar is fully functional and ties in directly to the frame members.



ERA's subframe for the Jaguar XJS independent rear end makes installation a simple bolt-in procedure.



ERA now boxes the X-member in the center of its frame for additional reinforcement. The slotted plate allows for a wide range of transmissions.

front A-arms, which are included). ERA can furnish any or all of these components, along with services such as frame painting and permanent installation of the fiberglass body. About half its customers opt for a partially completed rolling chassis that runs between \$5000 and \$7000 more than the standard assembly package. As with the 427SC model, the rear end is a Jaguar independent from either an XKE or an XJS (the latter requires narrowing and ERA's subframe).

ERA expects its new 289 FIA model to become a significant portion of its kit business, and early returns indicate strong interest, in part because this replica can legitimately use the less-costly small-block. And Cobra aficionados who care about that proper period treatment can be confident that ERA has properly reproduced a piece of a significant era. **KC**

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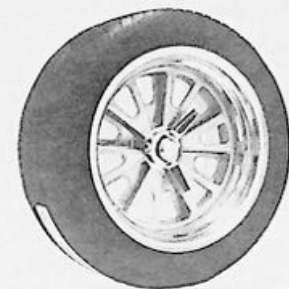
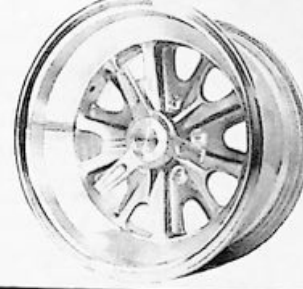
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# Suspension Tuning

## Getting Your Project Car's Wheels Into a Four-Part Harmony

By Bob Egginton

**A**lthough you may routinely tune your engine, how often do you tune your suspension? It requires just as much time and attention to keep your kit car in top performance. While some kit builders may prefer to take their vehicle to an alignment shop, it's possible to do the job in your own garage. Before we show how, though, let's go over some basic definitions.

**Camber** is the angle at which the wheel leans when viewed from the front of the vehicle and when compared to the road surface or the vehicle's vertical axis. A wheel can have positive or negative camber. Positive is when the top of the wheel leans away from the car's centerline. Negative is the opposite. It is when

the top of the wheel leans inward toward the car. Camber is measured in degrees, and a wheel that is absolutely vertical on a flat road is said to have zero camber (*Diagram 1*).

Tracing the earliest uses of camber helps to illustrate how it affects a vehicle's handling. When it came to building wheeled transport, our forefathers knew a thing or two, and the laws of physics never change. One of the things they discovered was that if you leaned the wheels outward at the top (positive camber), the load on the wheel and its central bearings was reduced. This enabled a lighter construction of wheel to be used and in turn reduced the overall weight of the vehicle's rotating parts.

In addition, an unforeseen and very welcome benefit resulted. Horsedrawn-carriage builders found that with the addition of a limited amount of positive camber came an unexpected increase in stability. This came about by the conical effect the camber produced (*Diagram 2*).

To illustrate this, imagine rolling a

cone across a flat surface. The cone would describe a curved path outward from its largest end. Two opposing cones would act against each other and cancel out this tendency toward curved paths. This is the principle that produced improved stability. Both positive and negative camber have this effect, and they are used in many other applications besides automobiles. In railroad rolling stock, for example, the wheels themselves are ground to a conical taper.

When the horseless carriage was invented, the technology employed in the horsedrawn predecessors was quickly adopted. Kingpin-type steering replaced the straight-beam axles of the horse and cart, but this led to wheel wobble. As speeds increased after the turn of the century, kingpin inclination (kpi) was introduced, which helped reduce steering loads and prevent the dreaded wheel wobble

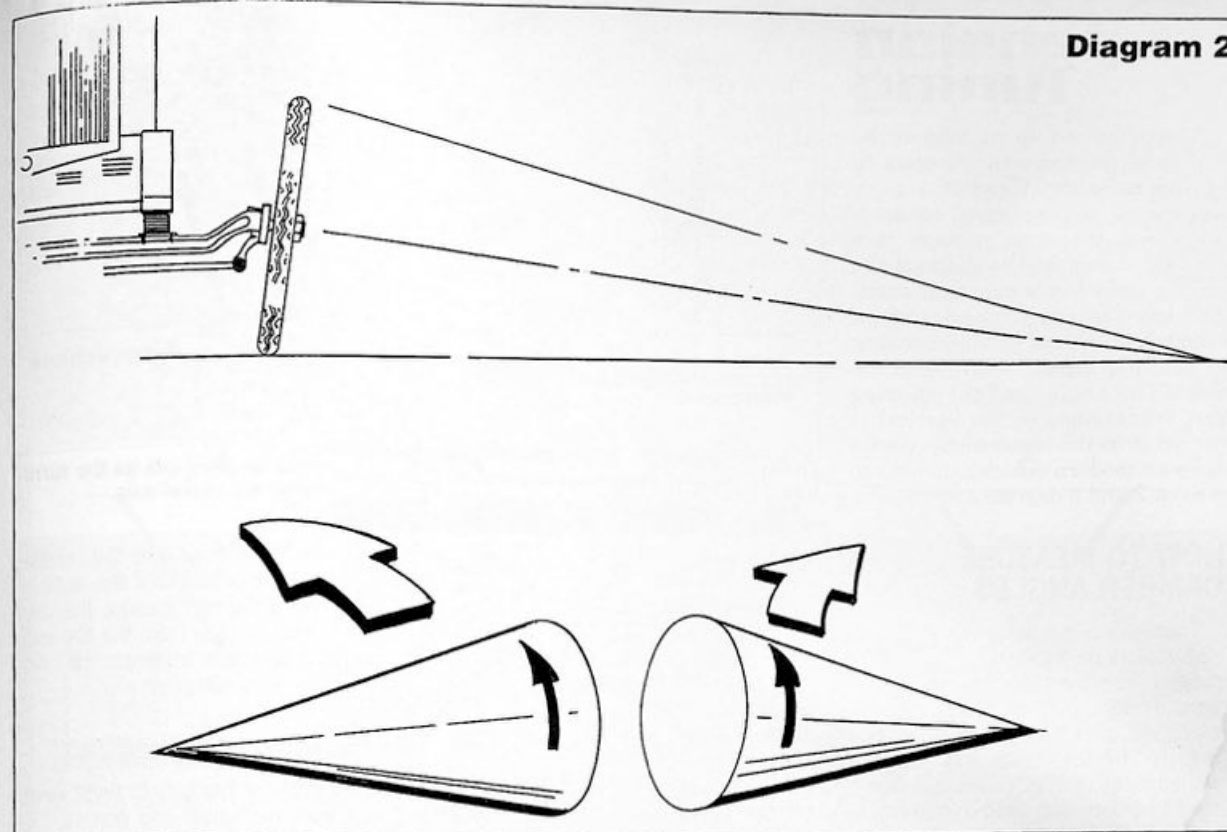
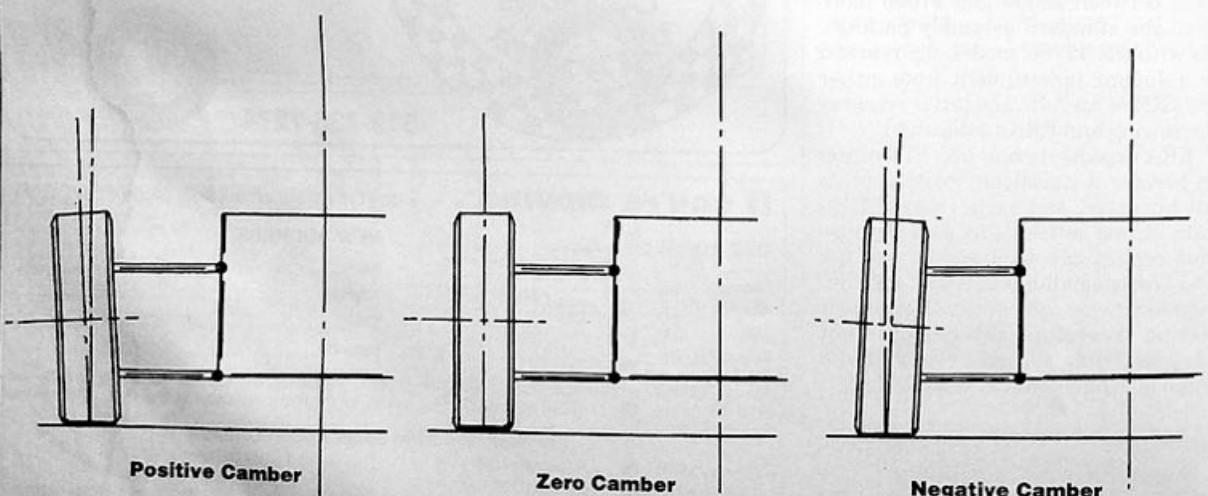


Diagram 2

Diagram 1



Camber can be positive or negative, and a totally vertical wheel has zero camber.

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ILLUSTRATIONS: BOB EGGINTON

ble (*Diagram 3*). The adoption of a small amount of toe-in further increased the stability of the cambered wheels, particularly on the rough roads of the day.

This basic specification remained more or less unchanged for the better part of 60 years until the '60s, when advances in suspension and tire technology dictated a change toward smaller, lighter-weight, and more rigid wheels. The smaller-diameter wheels, along with an increase in tire widths, went some way toward negating the need for positive camber. These changes led to the discovery that if a wheel was set statically with a degree or two of negative camber, the tires would work better when cornering. That's because body roll has the tendency to stand the outside wheel upright, producing a larger tire contact patch with more resultant grip. To this day, despite considerable advancements in suspension design, most modern vehicles have their wheels designed with cambers set from near vertical toward negative angles.

Although more difficult to show in a

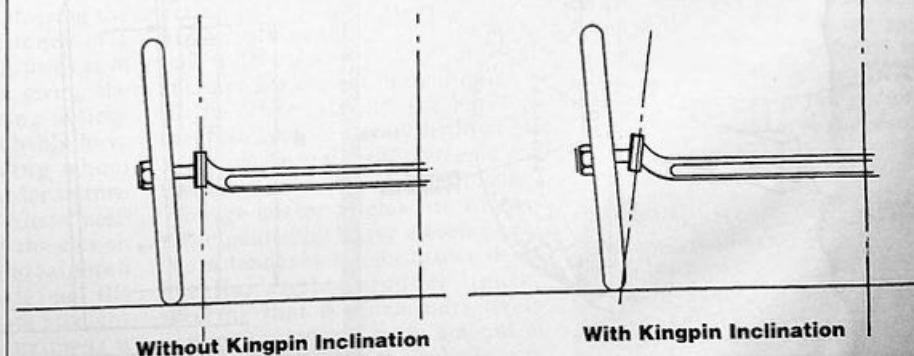
diagram, the conical effect applies in principle to negative camber as well. The increase in stability is not as pronounced, however, because the amount of camber angle used today is less than in the days of horse-drawn carriages.

**Caster** has also been with us in one form or another for several hundred years. Just as the name implies, the caster angles used on a vehicle's front wheels operate on the same principle as the little wheels fitted under your home furniture or on a grocery shopping cart. As a steerable wheel rolls forward, the steering

imagining positive camber as a cone illustrates how it causes a curved path for the wheel. Carriage builders used the conical effect of positive camber to improve stability.

pivot has a natural tendency to move ahead of the wheel center. When friction occurs between the floor and the tire contact point, the wheel is dragged into the position of least resistance, which is trailing behind its pivot. This is always the position in which the wheel is most stable and has the least tendency to run in any direction except a straight line (although for some reason the shop-

Diagram 3



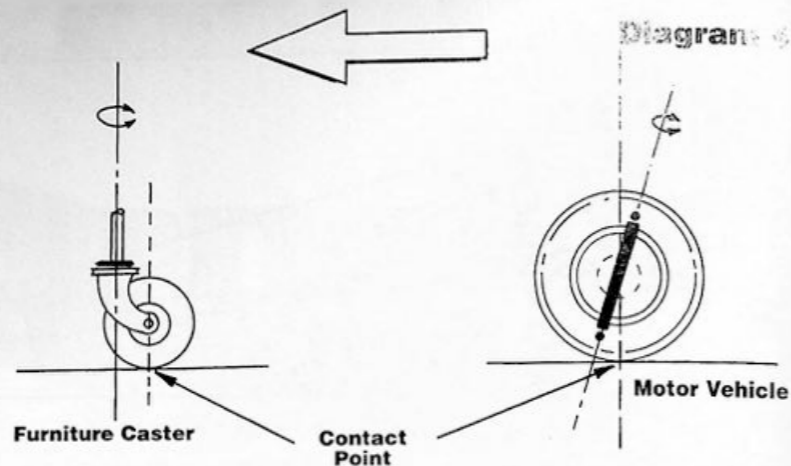
Kingpin inclination creates lighter steering with less wobble. The same principle applies to modern ball-joint suspensions.

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# Suspension Tuning

ping carts we end up pushing at the local grocery store always seem to defy this basic law of physics).

As shown in Diagram 4, an automobile uses the same principle as a furniture caster. In the diagram the steering pivot is shown at an angle. The angle creates a pivot axis in front of the wheel contact patch, producing the trailing effect required of the wheel. The angle that the steering pivot transcribes to the vertical is referred to as the caster angle. Caster angles on modern vehicles should run between 2 and 5 degrees and are usu-



The steering axis of an automobile (right) follows the same principle as the furniture caster, with the contact point of the wheel following the swivel axis.

## HOW TO MEASURE CAMBER ANGLES

There are a number of very accurate instruments on the market for this task, ranging from the classic Dunlop bubble-level system to much more elaborate electronic gadgets capable of measuring to better than 1/10 degree. Unfortunately, they're cost prohibitive to the kit builders who need to make occasional checks on their project vehicles. Of course, the other option is to visit your local alignment shop, state your requirements, pay up, and come away with the answers. But if you want to experiment with various settings on your kit (or are absolutely committed to doing everything yourself), it may be worth making a few simple tools and spending a happy hour or two in your garage at home.

Diagram 5 shows a simple, homemade gauge that with a bit of care can measure camber angles to within 1/2 degree of accuracy, which is probably sufficient for your needs. The diagram is

more or less self-explanatory. It is important when measuring to ensure that the vehicle is on level ground (use the bubble level), and it is vital when making your gauge to ensure that there is no play in the pivot and that the wooden slats are straight. A good-quality bubble level is essential as well.

Make sure the wheels are set straight ahead, then place the vertical slat of the camber gauge against the tire wall as shown, placing it off to one side so the bulge on the bottom of the tire won't affect the reading. Next, simply level up the bubble, read off the degrees on the protractor against the mark, and presto—you know your camber angle. Do the check two or three times after rolling the vehicle backward or forward, and take the reading on different parts of the tire to eliminate the chances of a bent wheel rim creating an inaccurate measurement.

An alternative method for the more mathematically minded measures camber by using a rule, a vertical bubble level, and a set of trigonometrical tables

or a scientific calculator. Lay the bubble level against the wheel until the bubble is centered, and then measure the distance the level is away from the tire and the vertical distance between the two points on the level (Diagram 6).

The formula is:

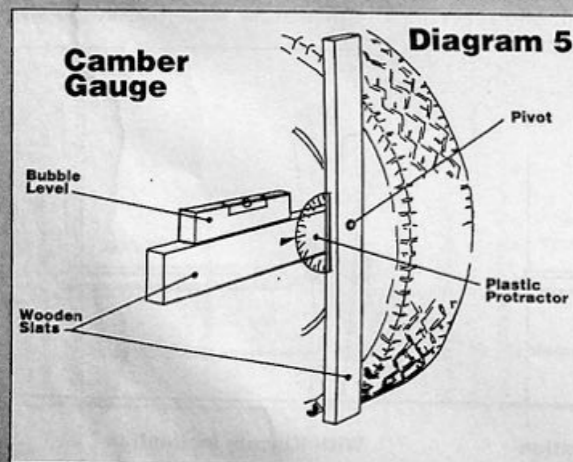
$$\text{Tangent camber angle (x)} = \frac{\text{Horizontal measurement (A)}}{\text{Vertical measurement (B)}}$$

For example, if the bubble level were 1/2 inch from the wheel and across 13-inch centers, the equation would be:

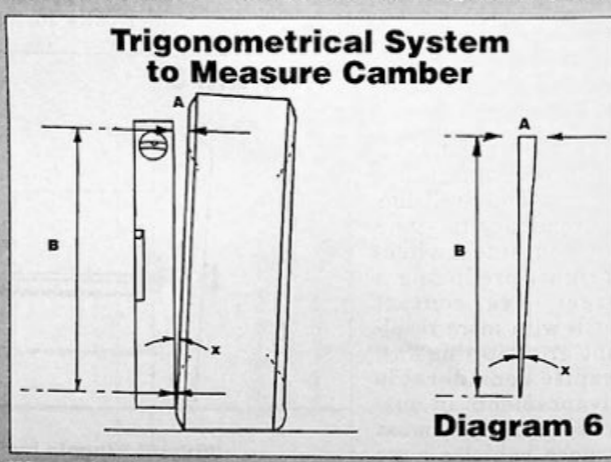
$$\frac{0.5}{13} = 0.03846$$

A quick glance at the tangent list or a press of the tangent key on a calculator will show that 0.03846 equates to 2 degrees, 20 minutes, or 2 1/3 degrees.

Changes to the camber are best done with the advice of an expert, but above all you need uniformity from side to side of the vehicle. Also remember that changes made to the front of the vehicle almost inevitably lead to a change in toe-in, and this must be adjusted to suit (see "Chassis Troubleshooting," January '95).



To ensure accuracy of the homemade camber gauge, be sure to keep the vertical slat away from the bulge at the bottom of the tire.



When using the mathematical method for determining camber angle, the bubble gauge should be set vertically and measurements should be taken at A and B, with angle X being the camber. Again, don't measure off the tire bulge at the bottom.

## HOW TO MEASURE CASTER ANGLES

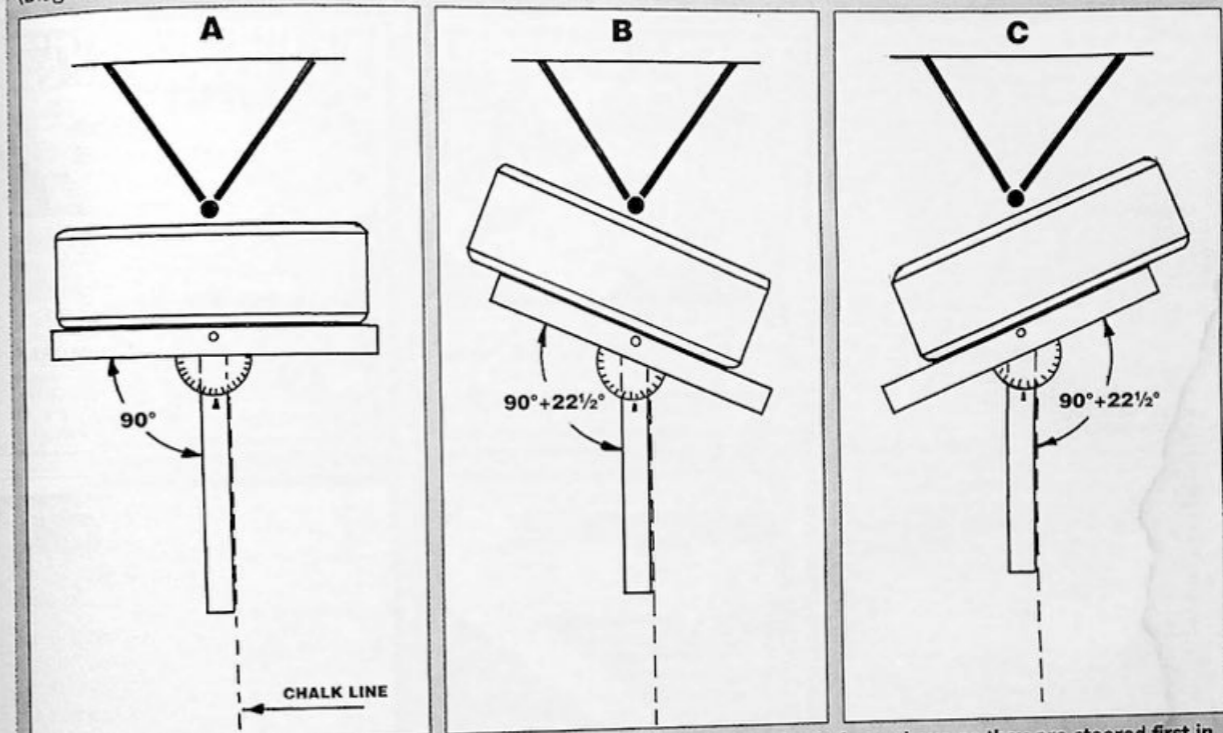
Caster measurement is a somewhat more complex job than camber measurement, and changing the caster angle on a vehicle should only be undertaken with extreme caution. Any wrong move can have dire consequences on the steering geometry. Also, considering the potential for inaccuracy in the somewhat rudimentary equipment described here, if you have the slightest doubts, take your vehicle to a good alignment shop. But for those who wish to try, here goes:

The vehicle must again be set dead level, and the parking brake must be firmly applied. Set the wheels straight ahead and use your homemade gauge to draw a chalk line on the ground at 90 degrees to the wheels' faces (Diagram A). Now using the chalk line as a ref-

erence, steer the wheel "in" toward the car 22 1/2 degrees (Diagram B). With the wheel in this position, turn the gauge vertically and measure the camber with the bubble set level. "Zero" the gauge by drawing a pencil mark on the slat next to the 90-degree figure on the protractor.

Next, using the chalk line and the gauge horizontally, steer the wheel "out" 22 1/2 degrees (Diagram C). Measure the camber again, leveling the bubble in its new position. Note the total number of degrees between the present setting and your pencil mark. This figure should be the caster angle.

It must be emphasized that the system laid out here probably isn't spot-on accurate. However, it is a good general indicator that will help you tell if you are on the right track or if you have a major problem with your project vehicle.



Use the homemade camber gauge to determine the steering angles for measuring caster. Here we are looking

at the front wheels from above as they are steered first in and then out.

ally designed into the vehicle.

Caster angles are used to aid steering stability, and they play a vital role in giving a vehicle's steering the correct "feel." The tendency of a wheel to trail its steering pivot is of paramount importance in giving the steering its self-centering action. When cornering, you probably have noticed that the steering wheel becomes progressively harder to turn from its neutral, straight-ahead position. Once having turned the corner, the wheel then tries to straighten itself out. In fact if you let go, the wheel will spin back to its straight position. This self-centering is a direct result of the caster angle.

The greater the amount of caster angle built into a vehicle, the greater the tendency for the wheel to trail the

pivot, and the greater the tendency for the vehicle to self-center and run straight and true. Dragsters are a prime example of this situation. Straight-line stability is all-important to them, so very large amounts of caster are evident in their designs. At the other extreme, the Formula cars use comparatively little angle and must be constantly "steered" by their drivers even on straight roads.

Large caster angles are always accompanied by heavy steering that has a tendency to feel rather dead. Smaller angles produce lighter steering that is much more lively and may require a large amount of skill, particularly if the vehicle is to be driven quickly.

The accompanying inset boxes show easy ways for kit builders to

determine both camber and caster angles (space doesn't permit showing how to make the actual adjustments on the wide variety of suspensions found on kit cars). While not as precise as the instruments found in an alignment shop, these measurement methods should help you personally tune your suspension so it doesn't hit any sour notes. KC

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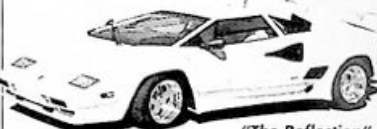


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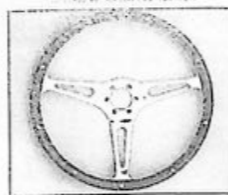
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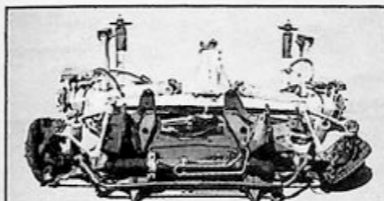
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## SHOW-OFF



### NASCAR COBRA

I've wanted a Cobra ever since my '70 Z/28 was badly beaten by a stock 427SC at the local dragstrip. I looked at several kit car manufacturers, and I knew that I had to have something that would outrun my ZR-1 and all the Elantras and Hondas out there. So I contacted Alan Weaver of Unique Motors in Gadsden, Alabama. This company built me a Cobra replica that I could drive on the street every day and take to the dragstrip on Saturday night and run in the 10s. Of course all of this power didn't come without the assistance of famed NASCAR engine builder Ernie Elliott. He put together an engine that dyno'd at 673 hp and 575 lb-ft of torque. All this from a 351W Ford block. I am extremely pleased with my car, so if you want a car that will outrun the Mustangs and Bugattis or even a Vector, Unique Motors will build it for you.

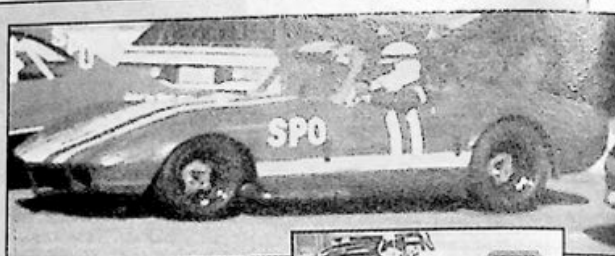
Terry McCumber  
Ridgely, MD



### THANKS FOR THE MEMORIES

Here is a picture of my completed Vela Rossa. This car turned out better than I thought it would. Without the help of my friend Scott Bruning, who is a fiberglass and paint genius, it wouldn't have turned out this well. I figured the body hanging was too much for me to handle, so I handed over all of the bodywork to him, and he did a meticulous job. He also designed a top for the Vela Rossa. My thanks also go out to John Washington of Vela Rossa Engineering, because he really treated me well when I had a question or two.

Seth Wallack  
Davis, CA



### WOODEN ONE-OFF

After filling out your reader survey, I thought you might be interested in my "kit" project. This race car has no Corvette parts. It started life as a GT-6 Triumph. After much modification, it now has four-wheel disc brakes and a 383ci small-block Chevy with a Powerglide transmission. And yes, it's covered in real wood—black oak and burl maple! At 1900 pounds and 450 hp, it's a good, quick ride.

Jack Banton  
Portland, OR



### BABY-BOOMER BENZ

Ever since I saw the Jovi LeBaron-to-SL conversion I have been impressed. I have always been an admirer of kit cars but like many was a little wary of the industry due to negative publicity and the uncertainty of the manufacturers' survivability. However, the Jovi conversion fits my needs perfectly. It is sporty enough for me and others like me who are from the baby-boomer generation. This car is a prestigious conversion that is a daily driver and also offers many conveniences of a family car.

Few of your readers may know that the Jovi conversion is the brainchild of internationally recognized German automotive designer and engineer Wolfgang Schultze. Having visited Wolfgang's shop in Florida twice before taking possession of my car, I can say that I found the staff to be highly professional and dedicated both to quality workmanship and customer satisfaction.

Edward J. Salazar, Ph.D.  
Arlington, VA

Dear Reader: Show us your kit car! We know how proud you must be, so here's your chance to tell others about it. Take a few snapshots, jot down some details about your project, and send them to Show-Off, Kit Car, 6420 Wilshire Blvd., Los Angeles, CA 90048-5515.

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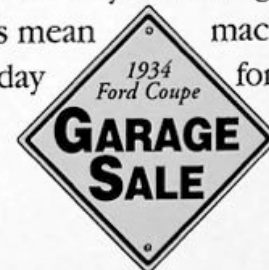


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